ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXVIII. No. 3291 DECEMBER 20, 1940 SIXPENCE

JAN 23 1941

MOBILIZED IN HUNDREDS OF THOUSANDS FOR NATIONAL SERVICE

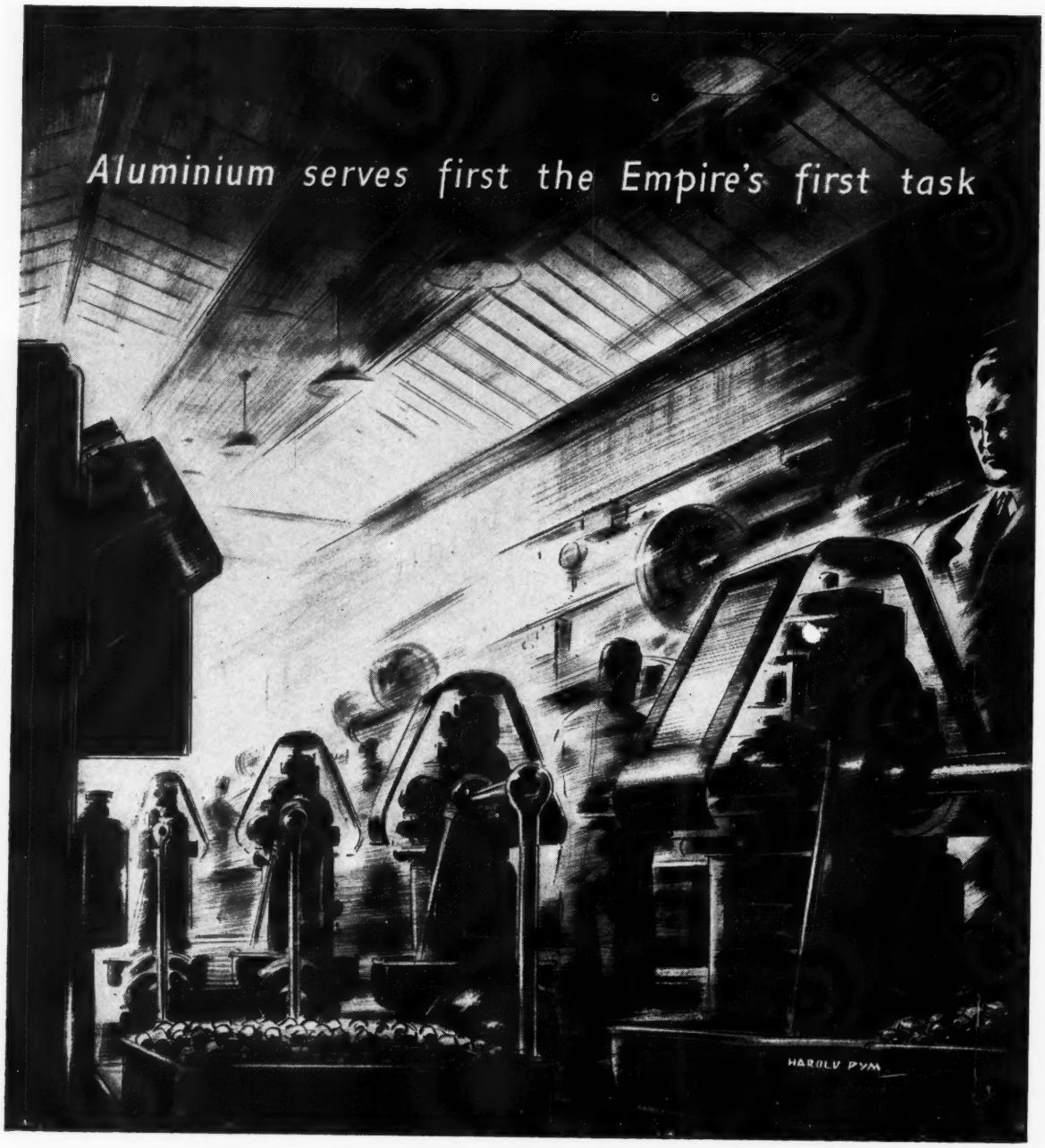
NATIONAL EMERGENCY

Please assist by saving all packing material for collection when our van calls.

G.E.C. FRACTIONAL H.P. MOTORS

The ideal units for an infinite variety of small power drives. All component parts made to gauge and interchangeable. Robust, reliable, quiet running

Advt. of The General Electric Co. Ltd. Head Office: Magnet House, Kingsway, London W.C.2

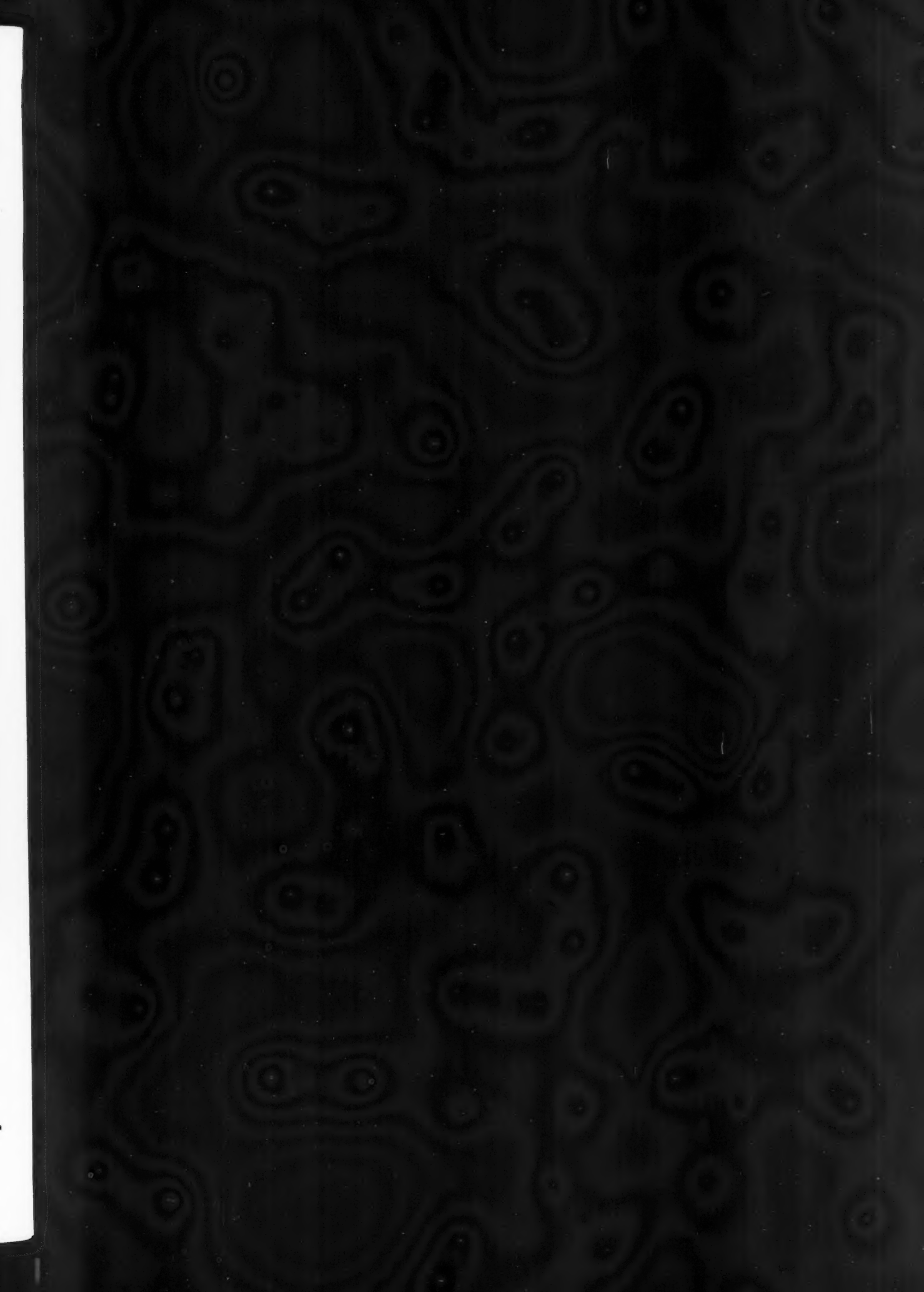


Users of aluminium and its alloys are invited to consult our Technical Service on any problem connected with the metal. Our publications are similarly available

THE
British Aluminium
CO. LTD

HEAD OFFICE : OAKLEY MANOR, BELLE VUE, SHREWSBURY, SHROPSHIRE
Telephone : Shrewsbury 4451 Telegrams : "Cryolite, Shrewsbury"

P29. E.R.



THE ELECTRICAL REVIEW

Volume CXXVIII — No. 3291

Friday, December 20th, 1940

Contents

	Page		Page
Editorial — Compensation for War Damage	147	War Damage Insurance	160
Boiler Furnaces. By "Entropy"	149	Power in Wartime. By V. A. H. Clements, A.M.I.E.E.	161
Personal	152	The 1940 Heat-drop Tables	162
New High-voltage Laboratory	153	Commercial and Industrial News	163
Institution Proceedings	155	Electricity Supply	165
Supply Authorities' Problems	157	Modified Slow Butt Welder	166
High-efficiency Fluorescence. By T. Thorne Baker	158	New Patents	167
Electric Furnace Transformers	159	Financial Section	168
		Contract Information	171

Classified Advertisements (Official Notices, Situations Vacant, etc.) — 41

Index to Advertisers — 58

EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1

Telegraphic Address: "Ageekay, Sedist, London." Code: A B C. Telephone No.: Waterloo 3333 (35 lines)

Subscription Rates, Postage free: United Kingdom, £1 16s. 10d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum

Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW LTD., and crossed "Lloyds Bank"

MINERVA

Insulating Varnishes and Compounds

The importance of electrical machinery and apparatus, in time of war, cannot be too highly stressed. Efficient operation of the vital components of Ships, Aeroplanes, Industrial Apparatus, etc., is essential. It is imperative, also, that the best electrical machinery be used as the motive power for machine tools employed in the manufacture of munitions. All risks of breakdown must be eliminated, and the selection of the most reliable insulation therefore becomes a matter of great importance. The perfect electrical machine *must* be perfectly insulated! Pinchin, Johnson & Co. Ltd. supply Insulating Varnishes and Compounds to the principal Electrical Manufacturing Companies, Railways, Tramways, Lighting and Power Stations. May we help you?

Specialist Manufacturers of Electrical and Industrial Finishes. Particulars on request.

Pinchin, Johnson

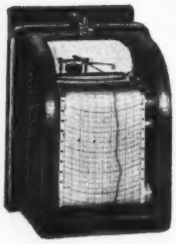
AND COY. LIMITED

Temporary Headquarters: WITLEY COURT, WITLEY, SURREY

Telephones: WORMLEY 280, 281, 282, 283 and 284 — *Ten minutes from Witley S.R Station*

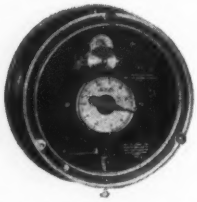
Temporary London Office: 6 ARLINGTON ST., ST. JAMES'S, LONDON, S.W.I. — Phone: REGent 0881

OTHER EVERETT EDGCUMBE PRODUCTS INCLUDE–



"INKWELL" GRAPHERS

To record Amperes—Volts—Watts—Power Factor—Frequency—Speed.



MAXIMUM DEMAND TELL-TALE

For consumers on maximum demand two-part tariff, enables standing charge to be kept at the lowest level.

SYNCLOCK TIME INTERVAL METERS

are invaluable for testing the time settings of Relays, Circuit Breakers and Integrating Meters, or other electrical apparatus in the operation of which time is an important feature.

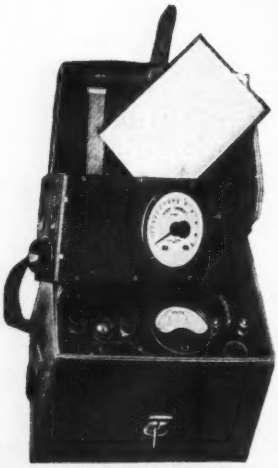
● **PRECISION MODEL.** An instrument of extreme sensitiveness which permits the shortest time intervals to be measured with an accuracy of 1/100th of a second.

● **INDUSTRIAL MODEL.** For measuring time intervals from 1/5th of a second up to 5 minutes with an accuracy of 1/20th of a second.

MAKERS OF ALL KINDS OF INDICATING & RECORDING ELECTRICAL MEASURING INSTRUMENTS

EVERETT EDGCUMBE

COLINDALE WORKS, LONDON, N.W.9

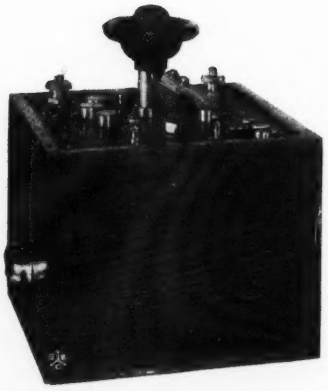


LOW RANGE PHOTO-METER
(for A.R.P. Lighting)

Measurement of illumination as low as 0.0002 foot-candle, surface brightness and candle-power.

PORTABLE TRANSFORMERS

for laboratory use, meter and general testing. Self-contained up to 500 amperes, with selector switch for certain ranges.



EVERETT EDGCUMBE PRECISION CURRENT TRANSFORMERS with associated instruments have long been employed by the N.P.L. and other standardising authorities throughout the world.

THE
ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXVIII. No. 3291 DECEMBER 20, 1940 Price SIXPENCE

Compensation for War Damage

An All-embracing Scheme

DURING the first year of the war the Government made a somewhat indefinite promise that compensation for damage caused to property by enemy action would be paid at some time after the war " so far as funds were available."

The necessity for a much more certain arrangement than this was constantly urged by industrial and commercial interests and attempts were made to meet the situation by the forming of mutual insurance groups. Events of the past three or four months have made it patent that the Government would have to act and the result is the War Damage Bill introduced by the Chancellor of the Exchequer last week, the main points of which are summarised on another page.

The Three Plans

Three compensation or insurance schemes are established by the measure; two, covering buildings and immovable property, and movable commercial and industrial assets, respectively, are compulsory and there is a voluntary scheme for " private chattels." The premiums (or " contributions ") in each case are high, in proportion to the risk, but they are admittedly arbitrary and may be reduced if they produce more than is needed to meet claims. Conversely, after the Exchequer has met a vast sum in excess of the available funds, it may be necessary to increase contributions.

To adopt the usual basis for premiums under the main scheme would have involved a special valuation of all properties—a course which might have taken years—and so the figure for income tax (Schedule A) purposes or the net annual rateable value has been taken. There are notorious disparities between assessments in different rating areas, but no other measure of value was immediately available. Actually, the insurance is effected by a single premium payable in five annual instalments and the schemes cover the first two years of the war and thus are largely retrospective. After August 31st next the matter will be reviewed and new legislation will be necessary for the extension of the scheme.

The time of payment of compensation is still to be governed by circumstances and, generally speaking, unless it is in the national interest to restore damaged property, it will have to await its turn until after the war, the unfortunate owners having to be content with accruing interest at 2½ per cent. on the compensation to which they are entitled. Nobody will consider this satisfactory, but in view of the pressure on the building industry and the shortage of materials it must be accepted as inevitable.

One thing in favour of the Part I scheme is that it spreads the cost over the whole of the community, so that the fortunate help to pay for damage which they escape. The voluntary schemes are on a less sound foundation, for only those in vulnerable areas will think it worth while to insure; people who fancy themselves to be safe will not be attracted. The schemes will be further weakened by the retention of the free insurance cover for those with limited incomes.

Supply Authorities' Position

Electricity supply undertakings realised quite early in the war that insurance against war damage was essential and they have been formulating plans for many months. A scheme has actually been prepared and submitted to the Electricity Commissioners, but it has had to await the advent of the Government's proposals. Now that these have appeared it is announced that special legislation is to be introduced shortly for the insurance of public utility undertakings. In the meantime, payment is to be made on account towards the cost of works certified by the " appropriate department " (the Electricity Commissioners in the case of electricity supply undertakings) to be urgently required.

Questions have been raised by electricity authorities regarding the situation created when goods which have been supplied by them to consumers on hire-purchase terms are damaged or destroyed. The I.M.E.A. solicitor recently stated that the ordinary rules regarding the insurance of such articles did not

hold good in present circumstances and the above-mentioned scheme of the supply authorities made special provision for the cover of hire-purchased apparatus. The new Bill, however, takes care of this by providing that hire-purchased goods shall become insurable under the commodities insurance scheme and that the power given to the Board of Trade to make goods voluntarily insurable under the scheme should be exercised in respect of future hire-purchase contracts.

Finding the Power

IN many ways the difficulties of electrifying armament work at very short notice are less pronounced than they were during the last war. In the first place, there need be no great concern as to the effect on the generating station of additional heavy demand, since local plant shortage can be met by importing current from the grid. Public supply mains are far more widely spread and the material and labour required to make a connection are consequently less. Then, too, greater attention has been given of recent years to planning distribution networks with an eye to potential demand, so that to take on a load of unexpected magnitude often means no more than using the cables to the full capacity sooner than the original estimate allowed for. Finally, owing to the larger number of consumers now connected, there is likely to be an increased diversity of apparatus in stock or which can be released from other consumers' premises in order to expedite the giving of urgent supplies. As Mr. V. A. H. Clements shows in this issue, the ability to render such vital aid depends upon a live outlook aided by intelligently kept records.

Keeping Up to Date

AN old, but increasingly important question, is raised in the October issue of *Science*. In a reference to the common reproach to scientific investigations that much of what is published is inadequately used, it is urged that more attention should be paid to the publication of condensed versions of long papers, which could be obtained elsewhere in their complete form, perhaps in inexpensive micro-film copies, by those more closely interested in their details. It is notorious that electrical engineers, for instance, would find it exceedingly difficult to become aware even of the existence of much that concerns their own special line of work if such information were not given as soon as it became available in the technical Press. Apart from this means, the difficulty of keeping abreast of developments would appear to be well-nigh insuperable.

Fuel Economy

IN normal years more than half of the 90 million tons of coal required for steam raising in Great Britain is burned under industrial boilers. In its newly issued Technical Booklet No. 13 (which gives a number of practical hints for the more efficient working of hand-fired boilers using bituminous coal) the Coal Utilisation Joint Council, supporting the plea of the Ministry of Mines for greater fuel economy, expresses the opinion that a saving of at least 10 per cent. can be made in the majority of industrial plants by improved operation and maintenance alone—and that without incurring expenditure on equipment not easily obtainable at the present time. If 4 million tons were saved, it is estimated that 10,000 wagons could be released for carrying other essential goods. It should, however, be borne in mind that this is merely a palliative, though possibly a necessary one under prevailing conditions. The best way, of course, is to transport the coal a shorter distance to a central station where electricity is produced by means of the most efficient methods of combustion and to use its associated distribution system for applying the power where it is needed. This would more certainly avoid the congestion of the railways, and also of the streets, that is inseparable from the delivery of coal to remote points of usage.

Night Traffic Accidents

FROM recently published figures it is clear that the decreased use of the streets at night is not reflected in a reduction of street accidents as it would be in normal times. Responsibility for this must be ascribed mainly to the low standards of public lighting necessitated by air attack possibilities. Even where such precautions are not called for, as in the electrically advanced United States, an imperfect realisation of the value of well-lighted thoroughfares results, according to the *General Electric Review*, in a preventable loss of 5,000 lives yearly. In support of this contention examples are cited of towns in which the position has been notably improved since modernising the street lighting. Thus, in the two years that have elapsed since a new system was introduced at Hartford (Conn.) it is estimated that the reduction in the night-accident rate has saved, in non-fatal injuries and damage to property, more than four times the whole cost of the installation. Although in the United States daylight fatalities are on the decline, there is still an upward tendency in accidents for the same traffic volume after nightfall, which account, it is said, for twice as many deaths as those due to aerial bombardment in Great Britain (8,500 at the date of publication of the article) taken over the same period.

Hydrogen-Cooled Generators

As a means of reducing windage losses, weight and dimensions of alternators and synchronous condensers, hydrogen is being used to an increasing extent. Two new alternators, one for the Central Illinois Light Co. (11.5 kV) and the other one for the Ohio Edison Co. (14.4 kV), will each have an output of 43,750 kVA at 3,600 RPM. They are similar in construction to the nine other Westinghouse machines of this type now in service. Hitherto the application of hydrogen to cooling has generally been restricted to large machines and its use for anything so small as the 500-kW 3,600-RPM motor-generator which was made for a Detroit concern represents a new departure. This set is required for high-frequency heating (at 9,600 cycles) for internal surface hardening. Since neither the generator nor the 800-HP squirrel-cage driving motor requires collecting rings the arrangements are simplified and are especially favourable to the use of hydrogen; also the internal gas pressure can be higher and more variable than is usually permissible. It is anticipated that the increased efficiency obtainable, together with lower maintenance costs, will defray the additional expenditure within two years.

BOILER FURNACES

An Aspect of American Power-Station Development

By "Entropy"

Compactness of high-capacity units is a feature of up-to-date boiler practice in the United States. The author reviews methods adopted to secure space economy

IN reviewing American central station boiler practice one is struck by the magnitude of the steam production from a single unit and the compactness of these high-capacity boilers. These features are most marked in boilers fired by pulverised coal and are made possible mainly by the consistency of fuel characteristics and by the adoption of methods by which extremely low gas temperatures at the stack may be avoided.

In general it may be said that the space required for combustion of a fuel is independent of the type of boiler which follows the furnace; thus the compactness of a unit is almost wholly prescribed by the combustion chamber. Whether a combustion chamber has to be large or small depends upon the temperature that can be permitted within the furnace, which in turn is controlled by the characteristics of the coal. Should the characteristics of the coal and load indicate that mechanical grates are required, the grate area is determined by the amount of coal that can be burned per unit area on the type of grate selected. The combustion chamber then becomes a flue connecting the grate with the boiler surface, the length being such as to ensure complete combustion before the gases make contact with the boiler heating surface.

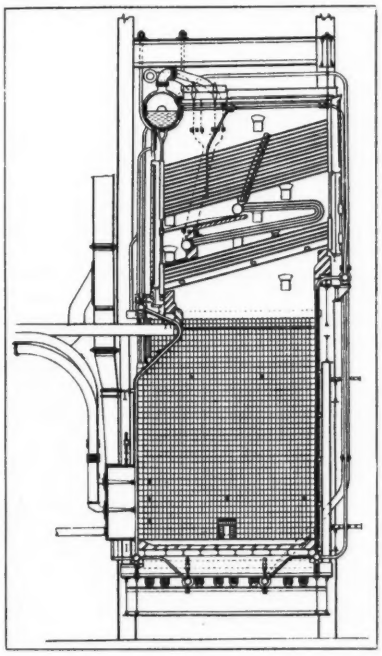


Fig. 1—Flat floor type of slag-tap furnace

This type of unit cannot be regarded as compact for the high-capacity units frequently encountered in American stations and it is no doubt for this reason that pulverised-coal firing is so widely adopted. While mechanical grates are sometimes considered suitable even for units of high capacity, a large proportion of installations are arranged for pulverised-fuel firing, and it is with this type of unit that the best examples of furnace and boiler development are to be found.

Reference has been made to the effect of fuel characteristics on the combustion chamber; if only bituminous coals are considered, which is usually the case with pulverised-coal firing, it will be found that ash content and ash fusion temperature are the main controlling factors. A certain period of time must be allowed for combustion to be completed and this is denoted by the distance allowed for flame travel, but this period can be shortened or lengthened according to whether the furnace temperature is high or low. Whether a furnace temperature is to be high or low is controlled by the ability of the furnace wall to withstand high temperatures coupled with the behaviour of the ash at the prevailing temperature. The prevailing temperatures should be such as to ensure the ash being in a solid state when the gases reach the boiler heating surface. Preferably this condition should also apply in the vicinity of the wall surface and if the furnace is arranged for dry-ash removal a low temperature in the ash pit is essential.

Only water-cooled furnace walls come into consideration for the reason that the dimensions of a furnace constructed with uncooled walls for the duties involved would be prohibitive. Exceptions are to be found, such as in installations burning coal of low volatile content or fired with mechanical grates demanding special settings, but these do not provide examples typical of the trend of design of generating stations.

For some considerable time American practice did not differ widely from our own, particularly in so far as it concerned pulverised-coal fired units. Combustion chambers were arranged for dry ash removal and dimensioned so that the gases reached the boiler heating surface at a suitable temperature to avoid slag formation. The duty obtained from a single unit seldom exceeded 250,000 lb. per hr., so that the combustion chamber dimensions did not have to be unduly large to ensure the desired results, especially when water-cooled walls were employed throughout. This type of unit is still used for moderate duties in the United States and also, with pulverised coal, at home.

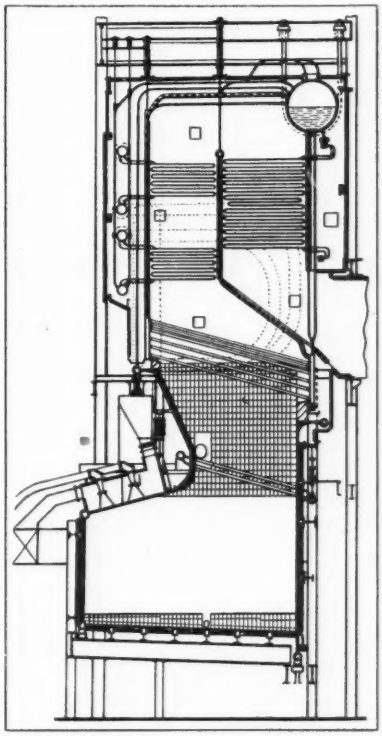


Fig. 2—Tube-screen arrangement

With regard to furnaces intended for dry-ash removal there has been little change in design during the past ten years and little difference between American and British practice. Then, as now, the furnace has a hopper bottom, across the top of which is a screen of tubes for chilling the ash into a dry state as it passes through to the ash pit; if this screen is not fitted, the faces of the hopper are water-cooled. Where the water-cooled construction is

chosen the hopper faces are a continuation of the water-cooled furnace walls, although to obtain the maximum chilling effect of the ash smooth-face metal blocks are clamped to the furnace wall tubes in the vicinity of the hopper bottom.

While furnace temperatures can rarely be carried sufficiently low to maintain the ash in a solid state, the employment of water-cooled furnace walls, formed either by fin tubes, block-covered tubes or closely pitched exposed tubes, causes a sufficient drop in temperatures local to the furnace walls to prevent undue ash accumulation. The heat absorbed by the furnace walls also has an appreciable effect in reducing the gas temperature at the entrance to the boiler heating surface.

With the tendency towards larger output from a single unit, the hopper-bottom type presents difficulty owing to the necessity of limiting gas temperatures at certain points in the furnace. The gas temperatures at these points can be maintained sufficiently low, provided the necessary amount of cooling surface is installed in the furnace, but therein lies the difficulty, especially for units which have become fashionable in the United States. A heat release rate of about 25,000 BThU per hr. per cu. ft. is generally found satisfactory for a duty of about 200,000 lb. per hr., but for double that capacity this rate of heat release would not only entail a somewhat cumbersome furnace but also higher temperatures for the reason that the area of the furnace envelope does not increase at the same rate as the furnace volume. Some manufacturers have met this difficulty by building water-cooled baffle walls in the furnace, but this system has not yet been generally adopted.

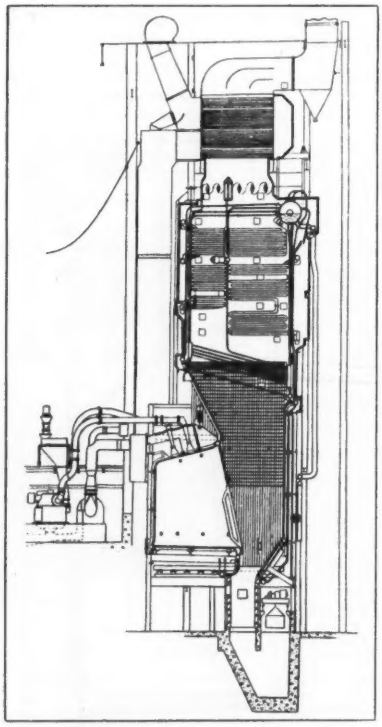


Fig. 3—Two-section furnace

Since one of the main difficulties in the operation of a hopper-bottom furnace for high capacity is to maintain the ash in a solid state at the essential positions, the slag-tap furnace, in which the ash is removed from the furnace in a fluid state, can be regardedas a logical development. In the days of its inception only coals of low ash-fusion temperature were regarded as suitable, and even then ash removal was attempted only during the time the boiler was operating at maximum load. In this type a flat floor inclined towards a tap hole is substituted for the hopper bottom, a typical example being indicated by fig. 1. Its dimensions are only slightly greater than those of the hopper-bottom type and the furnace conditions, except in the vicinity of the furnace floor, are little different.

The early form of slag-type furnace being rated only slightly higher than the hopper-bottom type did not demand any special form of boiler; consequently the normal baffled multi-drum or sectional-header type prevailed. The limitations were about the same as the hopper-bottom furnace; consequently it was not considered an ideal arrangement for units of high capacity such as were soon to be contemplated. Whilst the slag-tap furnace obviated the difficulty of ash removal at high capacities, the problem of ash accumulation at the gas entrance to the boiler tubes remained, on account of the limited amount of heatiug surface that could be installed in the furnace. The installation of the requisite radiant cooling surface in the furnace to satisfy the demands of high-capacity units resulted in excessive overall furnace dimensions with the added disadvantage that the temperature in the vicinity of the floor was reduced and so made slag removal more difficult.

Tube Screen Arrangement

The next stage in the development of the slag-tap furnace is shown by fig. 2, in which a screen of tubes is placed across the furnace roof at some considerable distance from the entrance to the boiler heating surface, the object being to obtain a rapid reduction in gas temperature and to arrest a considerable proportion of the ash that may be carried with the gases. The distribution of the tubes is such as to encourage the accumulation of slag without obstructing unduly the gas passage. As slag accumulation proceeds, the surface temperature increases until a stage is reached where the ash is chilled insufficiently to solidify. At this point accumulation ceases and a continuous dripping of molten slag commences.

In this manner greatly increased furnace ratings can be permitted without endangering the gas entrance to the boiler. The increased furnace rating raises the temperature below the screen and in particular in the vicinity of the floor, thereby improving the conditions for molten slag removal. The latter condition is further improved by the installation of vertical burners arranged to impinge on the floor. The length of flame travel is considerably less than with the former types of pulverised-fuel-fired furnaces, but combustion is more rapidly completed on account of the higher temperatures prevailing in the combustion zone. The introduction of the stud-tube wall made possible this increase in furnace temperature without impairing furnace maintenance and at the same time produced the necessary heat-absorbing qualities to prevent undue slag accumulation on the furnace walls.

Unbaffled Heating Surface

Changes in the design of the boiler plant indicated in fig. 2 will also be noted, which in the main can be attributed to increased furnace rating and the desire for higher final steam temperatures. As a consequence of higher furnace rating the gas weight per unit width of boiler is increased to such an extent that to keep the draught loss within economic limits the heating surface is not baffled. In order to obtain high final steam temperature the superheater is formed by a series of loops installed in the upward gas pass, and in the plant illustrated it is arranged in sections so that an attemperator may be installed between them for temperature control.

A further point of interest is that the usual convection bank, installed after the superheater, is formed by a section of continuous tubes of small diameter with a forced water flow, this change providing the most economical arrangement of heating surface. The advantages of this type of unit may be summarised briefly as allowing greater latitude in the choice of fuel and permitting a greater steam production from a given floor space.

To meet the demand for still greater steam production from a single unit and from a given floor space the type shown by fig. 3 was evolved. In this case the position of the screen is modified so as to divide the furnace into two

sections: the primary stage in which combustion and slag removal take place, and the secondary stage, in which any suspended ash is chilled. In thus forming the primary section, the active combustion zone is reduced in volume, thereby increasing the furnace temperature and so compensating for the reduction in combustion space. This increase in temperature also makes for easier removal of ash in a fluid state, to such an extent that slag discharge is continuous through openings in the furnace screen. The gases leave the primary zone through staggered openings in the furnace screen, these openings being kept clear by the liquidation of the slag after a certain amount of accumulation has taken place.

The secondary zone is also completely water cooled and is so dimensioned that it contains sufficient heat-absorbing surface to ensure that any ash which may have penetrated the furnace screen will be effectively chilled before reaching the boiler heating surface. This section of the furnace is provided with a hopper bottom so that any ash falling out of suspension can be delivered to the common ash pit.

Control of Gas Flow

The boiler installed in conjunction with this type of furnace is also of particular interest. The extremely high furnace rating results in a high gas weight per unit width and to keep the draught loss within economic limit the main convection bank of the boiler is not baffled. Further there is parallel gas flow through the superheater and the forced-flow convection bank. The flow of gas over the superheater and secondary convection bank or economiser is controlled by damper, being made greater or smaller over the superheater to regulate the final steam temperature, while it may also be diverted through the economiser during the starting up stages to avoid overheating the superheater elements.

A further development of this two-stage type of furnace that is particularly suitable where head room is limited is shown in fig. 4. The principles of the combustion chamber are akin to those of the preceding design, but there is a marked difference in the design and construction of the secondary zone. When the gases leave the primary section they pass through a slag-collecting screen and thence in an upward direction through a water-cooled flue. At the top of this flue the gases again pass through a screen of staggered tubes and then in a downward direction through a completely water-cooled flue. In the passage through the water-cooled screens and flues the gases impart sufficient heat by radiation and convection to the boiler system to reduce the gas temperature to a point which would render harmless any ash particles which may be entrained with the gases.

Two Ash-disharge Positions

At this stage the gases enter nests of small-bore tubes forming the economisers and superheater, in so doing passing over a hopper bottom designed to handle dry ash. The design thus differs from that indicated by fig. 3 in that there are two distinct positions of ash discharge, one being from the primary furnace where the ash is molten and the second for dry ash removal. The economiser and superheater are side by side in parallel flow so that by adjustment of the rate of gas flow the final steam temperature can be regulated.

Final compactness in layout is obtained by designing the plant for a relatively high gas-exit temperature. At the exit end of a boiler plant the temperature head between the gases and the heat-absorbing medium diminishes rapidly, with the result that the heating surface required for gas temperature reduction increases at an alarming rate. In designing for a relatively high gas-exit temperature, efficiency is sacrificed to the tune of 1 or even 2 per cent. (in terms of gas loss), but it is considered that adequate compensation is provided by the relatively small pressure heating surface required and overall compactness. There is in fact an improvement in radiation losses on account of the relatively small external surface area of a highly rated compact plant, whilst in many instances a high final gas temperature provides a solution for air heater corrosion.

It might be concluded from the foregoing review that there is now no place for the unit arranged for dry-ash removal. This, however, is not the case. There are still many instances where the steam demand is moderate or where a continuous supply of coal having a high ash-fusion temperature is assured. These conditions are hazardous for slag-tap units but ideal for hopper-bottom units and

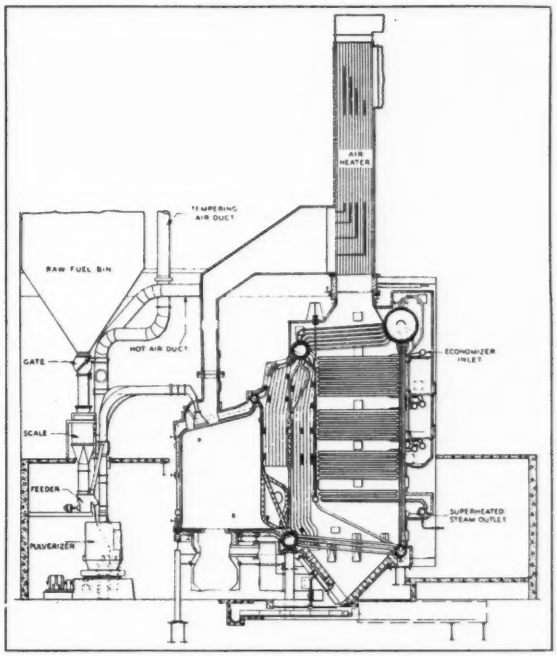


Fig. 4—Two-stage unit for limited headroom

mechanical grates, which consequently continue to find application. Units of this description, however, are rarely spectacular. While it may be claimed that outstanding improvements have taken place in the design of this type of unit, many of the changes have been inherited from the slag-tap unit where progressive increase in ratings and production have made these changes necessary.

Repairing Air-raid Damage

IN the House of Commons Mr. Parker recently asked the Minister of Transport whether he was aware that a house in Dagenham was damaged by a bomb in October; that the County of London Electric Supply Co. disconnected the power until first-aid repairs had been completed; that tests then showed "shorts" and dead earths; that the company then refused to examine wiring further or make the necessary repairs without receiving a deposit of £3; and whether he would take action to see that the necessary repairs to lighting were effected after bombing without such charges.

Mr. F. Montague, who replied, said he understood that in the case referred to the consumer's electrical installation was damaged. The responsibility for the repair of such damage rested with the consumer or the owner of the installation, and the company was under no obligation to carry out such repairs without charge. As required by the Regulations of the Electricity Commissioners, the company drew the attention of the consumer to the defects which would require attention and quoted the terms, *viz.* £3 payable in advance, on which it was prepared to carry out the repairs. There was no obligation on the consumer to accept this quotation and he understood that in fact he made other arrangements for the repair of his installation.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

THE Board of Examiners has now announced its decision in connection with the W. E. Highfield Shield Competition, 1940, held under the auspices of the Association of Supervising Electrical Engineers. The awards made are as follows :—The shield and first prize (£5 5s.) (including replica of shield): **Mr. G. A. T. Burdett,** London, for his paper "Some Aspects of the Use of Electricity in Aircraft"; second prize (£3 3s.): **Mr. R. H. L. Andrew,** Macclesfield, for his paper "Pride of Industry"; and third prize (£2 2s.): **Mr. A. E. Payne,** London, for his paper "What is Power Factor?" The shield and prizes will be presented early in the New Year. The members of the Examining Board were Messrs. H. W. Swann (president), J. R. Beard (immediate past-president), F. W. Smith (chairman of the Association), and W. R. Durtnall, member of the Executive Council.

Mr. J. F. Field, B.Sc., A.M.Inst.C.E., A.M.I.E.E., whose appointment as deputy engineer and manager of the Edinburgh Electricity Department was confirmed by the Corporation on December 5th, is in the chief engineer's department of the Central Electricity Board, where he has had considerable experience in the design and construction of electrical generating plant. After graduating from Edinburgh University in 1924, he joined the British Thomson-Houston Co., Ltd., at Rugby, as a student apprentice, subsequently becoming a steam turbine erector, designing engineer, and contract engineer on turbine sales. He went to America in 1930 and after some time with the General Electric Co. in Schenectady, he joined the Brooklyn Edison Co.'s plant equipment bureau and assisted in the installation of two 160,000-kW sets and five 130,000 lb. per hour boilers in Hudson Avenue.

On his return to England he carried out a large factory reconstruction work for the Calico Printers' Association, Manchester, before joining the staff of the Central Electricity Board at the end of 1933. He was awarded a Telford Premium by the Institution of Civil Engineers for his paper on "Standard Steam Cycles" which was published in that institution's *Journal* in December, 1938. Mr. Field was selected from thirty-one applicants and his commencing salary will be £700 per annum.

Mr. Leslie Gamage, director and secretary of the General Electric Co., Ltd., has been elected president of the Chartered Institute of Secretaries for the ensuing year. Mr. Gamage is responsible for the overseas business of the G.E.C., and it will be recalled that he contributed an article which attracted much attention in the Dominions to our Special Export Issue in March last.

Mr. Eustace Thomas, of Bertram Thomas, Ltd., has contributed £5,000 to the Manchester Aircraft Fund for the purchase of a "Spitfire."

Mr. A. McCulloch, electrical engineer with the City Electric Light Co., Ltd., Brisbane, has been appointed to the Queensland Munitions Board.

In accordance with a resolution of the Edinburgh Electrical Society and the Royal Scottish Society of Arts, a committee has been appointed to celebrate the centenary of the invention of electric clocks by Alexander Bain. The Committee, which consists of Col. H. Carter, Prof. S. Parker Smith, and Messrs. J. Eccles, C. N. Kemp, D. Smeaton Munro, A. Steuart and P. d'E. Stowell, has arranged for the erection of a tablet at Bain's workshop at 21, Hanover Street and for two lectures on Bain's inventions.

Mr. G. Conradi, of the British Central Electrical Co., Ltd., has recently been given a commission in the R.A.O.C.

Sir Harold E. Yarrow, Bt., C.B.E., Glasgow, has been appointed a director of the Clyde Valley Electrical Power Co., and of its three subsidiaries, the Lanarkshire Hydro-Electric Power Co., the Strathclyde Electricity Supply Co., Ltd., and the Clyde Valley Accessories, Ltd.

The Council of the Institution of Electrical Engineers has awarded the Page Prize for 1939-40 (value approximately £5) to **Mr. H. G. Dennes** for his thesis entitled "The Conversion of a 1,250-kVA Hydraulic Generating Plant to Semi-Automatic Operation." The award is made for the best thesis submitted in lieu of the associate membership examination.

Mr. W. N. Dobing, assistant works superintendent with the Leeds Corporation Electricity Department, who recently retired, has been presented by the staff with a gold watch. Mr. Dobing joined the Corporation Electricity Department over twenty-two years ago as shift charge engineer.

Mr. W. J. Forster, of Middlesex, has been recommended for the appointment of deputy borough electrical engineer at Walthamstow.

Mr. A. Reynolds informs us that he has severed his connection with the Cooper-Stewart Engineering Co., and has taken an interest in H. M. Walters & Co., Diceland Works, Banstead, Surrey.

Miss Lesley S. Souter, B.Sc., an honours graduate of Glasgow University, and a member of the staff of the General Electric Co., Ltd., is stated to be the first woman candidate of the Royal Technical College, Glasgow, to secure the Associateship of the College in electrical engineering.

Mr. R. G. Hopkinson, B.Sc. (Eng.), A.M.I.E.E., has received the Ph.D. degree of London University for a thesis on work carried out largely at the G.E.C. Research Laboratories during his fourth year at Faraday House.

Obituary

Mr. A. Maguire.—The death occurred on December 5th of Mr. Angus Maguire, of the Electric Construction Co., Ltd. Mr. Maguire, who was one of the oldest members of the company's staff, received his technical training at the City and Guilds of London Institute, after which he was articled as a pupil to the Electric Construction Co. (in 1894) and in due course became a designer. Later he was appointed a sales engineer in London, which position he held until his death.

Mr. L. E. Wilson.—We regret to learn of the sudden death of Mr. Lancelot Edward Wilson, M.I.E.E., proprietor of L. E. Wilson & Co., Ltd., of Manchester, which occurred on December 3rd at the age of 69. Mr. Wilson was educated at the Cathedral School, Norwich, and received his electrical training with the South of England Telephone Co. and the Eastern Counties United and National Telephone Company, and was for five years chief electrician of the western district of the National Telephone Co., with whom he became metropolitan workshops superintendent in 1900, and chief electrician, Manchester, in 1902, holding the last-mentioned position until 1905, in which year he established the firm bearing his name.

Mr. G. R. Todman.—We regret to record the death of Mr. G. R. Todman, manager of the Meter Department of Siemens Electric Lamps & Supplies, Ltd., which occurred at the Royal Masonic Hospital, London, on December 8th.

Mr. George E. Dashwood, for many years in business as an electrical engineer in Lower Bridge Street, Canterbury, died on November 21st, aged seventy-two. For several years he was responsible for the decorative lighting used in connection with the Canterbury Cricket Week Festival.

Mr. Edgar Moxon, who was formerly borough electrical engineer at South Shields, has died at Bridlington at the age of sixty-one.

Mr. J. R. Fulton.—The death is reported of Mr. J. R. Fulton, who had been a member of the Southern Rhodesia Electricity Supply Commission since 1935. He had previously been, for about eight years, a member of the Colony's Railway Commission.

Mr. L. Burbridge, formerly London manager for Blackstone & Co., Ltd., and for many years with R. A. Lister & Co., died in Kingston County Hospital recently at the age of 52.

Mr. J. G. Waldron, electrical engineer to the Forbes (N.S.W.) Municipality, died recently from injuries received in a car accident.

Mr. E. H. R. Trenow.—The death has occurred at Bath, at the age of 78, of Mr. E. H. R. Trenow, formerly managing director of the Bath tramways undertaking. He was managing director of Bath Tramways, Ltd. and its subsidiary, Bath Tramways Motor Co., Ltd., until they became associated with the Bristol Tramways & Carriage Co., of which he also became a director following the amalgamation. He became managing director of the Bath companies in 1927 and remained a director up to the time of his death.

Wills.—Mr. C. Ker, chairman of the Clyde Valley Electrical Power Co., and its subsidiaries, left personal estate in Great Britain valued at £92,204.

Sir Oliver Lodge, F.R.S., left estate valued at £27,899 (£27,730 net.).

I.E.E. Arrangements

IN order to comply with the bye-laws, a formal ordinary meeting of the I.E.E. will be held on January 2nd, at 12.30 p.m. for the suspension of a list of applicants for election and transfer approved by the Council for ballot.

The Council has decided that under prevailing conditions it would be inadvisable to hold meetings of the Institution in London during the second half of the session. Particulars of the papers that would have been included in the programme will be published in the January issue of Part I of the *Journal* so that applications for advance copies can be made to the secretary at the appropriate time by those members who contemplate the submission of written contributions for publication, in the form of discussion, in the *Journal*.

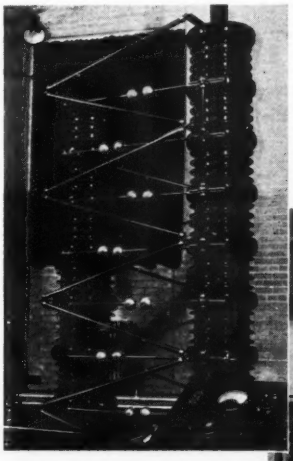
NEW HIGH-VOLTAGE LABORATORY

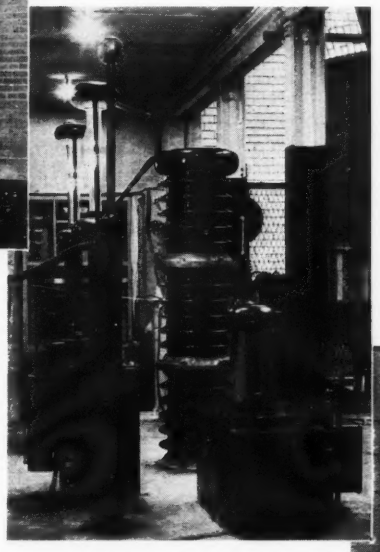
Extensions at Liverpool University

OWING to the generosity of the late Mr. G. H. Nisbett, British Insulated Cables, Ltd., the Automatic Electric Co., Ltd., and Liverpool Corporation, extensions have been made to the Electrical Engineering Department of the University of Liverpool. The principal feature of this development is the high-voltage laboratory opened on November 29th by Mr. B. Welbourn, chief engineer, British Insulated Cables, Ltd., as reported in our issue of December 13th.

Lancashire electrical manufacturers, upon the initiative of the late Mr. G. H. Nisbett, have combined to equip this valuable addition to the Electrical Engineering Department of Liverpool University which will be particularly useful for cable testing

The installation includes a 1,000-kV impulse generator of large capacitance for cable testing, together with a continuously-evacuated cathode-ray oscillograph for recording surges and a 300-kV, 150-kVA high-voltage transformer for tests on cables and insulators at power frequencies.





Above : 1,000,000 V impulse generator
Right : Charging set

Due to the limited floor space available, a new type of impulse generator had to be designed with a one-metre sphere gap, which is arranged above the condensers. A pit 10 ft. by 6 ft. by 3 ft. deep provides additional headroom for the sphere-gap—the length of which can be measured on a scale close to a control desk. Eight sections of B.I.C. condensers, each of 0.2 μF capacitance, are charged to 125 kV from a high-voltage transformer supplying DC through a two-stage voltage multiplier. The condensers are discharged in series by spark gaps, as in the standard Marx generator. The arrangement of charging and tail resistances is normal, but part of the front resistance is distributed in the various stages of the generator in order to economise space. The discharge resistances can be varied so as to give either a 5, 50, 150 or 1,500 micro-sec. wave tail. With the 5 micro-sec. wave tail, the impulses at the first sphere gap were initially irregular, only about half of the flash-overs producing an impulse.

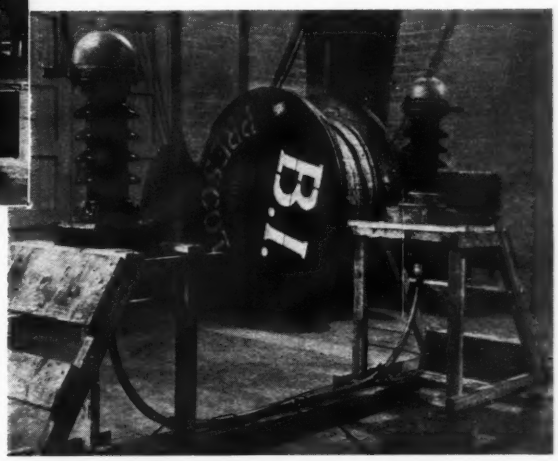
Investigations by Dr. T. E. Allibone and Mr. F. S. Edwards indicated that these breakdowns at lower voltages were due largely to dust in the gaps. When the gaps were surrounded by insulated cylinders with their insides coated with vaseline to collect particles, the first gap sparked over regularly at standard-table values, but the remaining gaps did not. Further investigation showed that, owing to the shrouding of the first gap, light from the spark could not fall on the others and this prevented the preliminary ionisation required to establish the initial spark. With slits in these cylinders over 90 per cent. of the initial discharges produced impulses. When these condensers are discharged in series they give a maximum voltage of 1,000 kV.

The capacitance of the impulse generator is large enough to prevent the insertion of the test sample from affecting the nature of the impulse applied to it. With a sample of paper-insulated cable with two sealing ends, the voltage on the impulse generator was gradually raised to 335 kV, when the ends flashed over. The actual spark-over distance was 16 in. The thickness of the dielectric was 0.32 in. and there was no sign of breakdown of the paper. The impulses used were 1/50 and 1/5 micro-sec. In this test the impulse travelling from one end of an 11-ft. length of cable was reflected at the far end and reflected once more at the flash-over end, the interval between the impulses corresponding with the time taken in travelling from one end of the cable to the other through the dielectric.

Cathode-Ray Oscillograph

A cathode-ray oscillograph coupled to the generator by a resistance type of potential divider enables the shape of the impulse wave of voltage to be studied and the magnitude of the generator output voltage to be measured. It is similar to that described by Birch and Whelpton (*I.E.E. Journal*, Vol. 71, No. 428) with certain improvements. The tube is of the high-voltage continuously-evacuated type, the beam being formed in a discharge tube with 20 kV across the anode to cathode space and having its intensity controlled by an air-leak valve. Magnetic focusing and positioning of the beam is employed, whereas the time-base and transient deflections are produced electrostatically, the deflector plates being designed to operate with 500 V across each pair.

The time-base plates are symmetrically electrified with respect to earth by a condenser discharging through a resistance, and speed adjustment is obtained by choice of one of six resistances in combination with either of two condensers. The electron beam is normally trapped in a deflected position by a high potential applied to an assembly of three sets of parallel plates. Release of the beam from its " trap " and initiation of the time sweep is attained simultaneously by a three-ball amphi-polar spark relay which is itself initiated by the electro-magnetic wave of the impulse to be recorded.



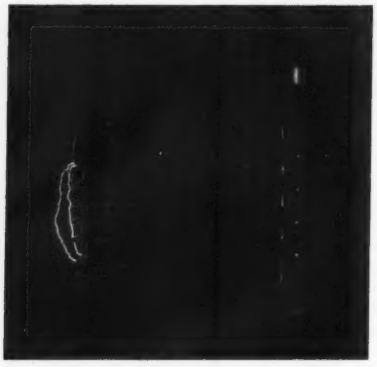
Cable with sealing end insulators

A length of concentric cable between the potential divider and the transient deflection plates allows a sufficient interval of

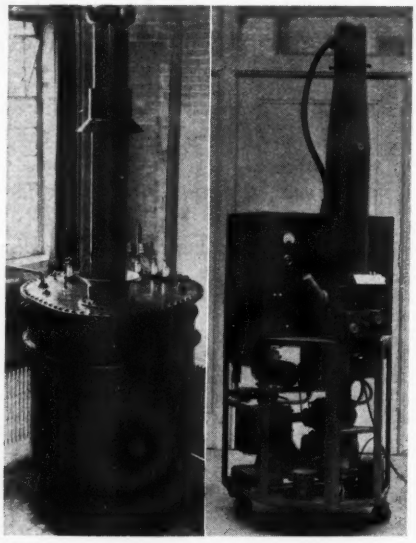
time for the beam to commence its travel before the transient appears at the plates. Visual observation of the transient is by means of a fluorescent screen on to which the beam is focused. This screen is formed on the lid of the camera box used for obtaining permanent records of the transients by electron blackening on roll film.

The vacuum in the main tube, 10^{-4} mm. of mercury, is obtained by condensation or oil-diffusion pumps, the backing vacuum being introduced by a two-stage rotary vane-box pump. The complete layout comprising oscillograph tubes, auxiliary 20-kV rectifiers, beam trap and time-sweep ancillaries and vacuum producing plant are built in one compact assembly forming an easily transportable unit.

In another part of the laboratory a high-frequency high-voltage testing plant (designed by Dr. W. H. Penley) has been installed to provide voltages up to 80 kV at frequencies of 500 to 1,000 kilocycles. The method adopted for the exact control of frequency by a crystal, with a view to measuring the power factor of the dielectric near the voltage of breakdown, depends on the measurement of the additional voltage on the primary of the input transformer that is required to maintain a constant voltage on the test specimen. Tests of insulating materials, using both power-frequency and high-frequency voltage, show striking differences with glass and porcelain insulators, but many of the fibrous materials become practically valueless for insulation at high frequencies.



Flash-over at insulator at 335-kV



Left : 300-kV transformer.
Right : Cathode-ray oscillograph

The accompanying table indicates that the peak voltage required for breakdown is very much reduced in both samples, especially in the case of sample A. With glass the ratio is even greater, the breakdown voltage stress at 1,000 kc/s being about one tenth of that at 50 cycles.

The high-voltage transformer, supplied by Ferranti, Ltd., has its voltage controlled within a continuous range of from 0 to 300 kV by a Ferranti regulator. A desk-type control panel contains a 350-A double-pole hand-operated circuit-breaker fitted with a current transformer with overload and field coils for operating from a 230-V supply. Signal lamps (red, green and amber) indicate the position of the circuit-breaker and interlocks. Two-speed control gives, in the "fast" position, a rate of increase of 5 kV per sec. and is suitable for testing ceramic and similar materials. The "slow" position gives approximately 1,250 V per second and may be used for testing cables. A 6-in. voltmeter on the desk indicates the transformer primary voltage, and a 6-in. ammeter with two ranges, operated from a 4 : 1 tapped current transformer, indicates the primary current on the transformer.

The magnetising current of the transformer at full load is about 40 A. Its secondary voltage is indicated by the 6-in. kilovoltmeter provided with two ranges operated from the voltmeter winding of the testing transformer. The desk panel also contains a master key switch and a trip and auxiliary circuit fuses.

In addition there is a sheet-steel wall-mounted panel fitted with double-pole instantaneous relays with one element arranged for over currents, adjustable in the ratio of 16 : 1 (from 12½ to 200 per cent.) at full-load current. The other element of the relay is arranged for over voltage protection. A 200-A conductor mounted on the side of the moving-coil regulator short-circuits the secondary windings of the regulator in the minimum-voltage position, so that the balancing of voltages takes effect before the transformer is energised, thus avoiding the possibility of switching surges. For testing insulators under working atmospheric conditions, a lead-through insulator has been built into the roof and a gallows built of girders has been set up from which test insulators can be suspended.

TABLE

Material	*Thickness c.m.*	*kV peak at 600 kc/s*	*Volts per m.m.*	*kV peak at 50 c/s*	*Volts per m.m.*
A	0.625	17	2,720	80	12,800
B	0.625	24.1	3,880	38	6,080

Power for U.S. Army Camps

"Generous" Response of Utilities

THE *Electrical World* (New York) reports that private power companies are "volunteering generously" in construction of special high-voltage transmission lines to supply power to the new Army camps springing up for training the nation's expanded military force.

Three contracts already have been negotiated by the Quartermaster Division with private utilities to supply two camps, and a fourth contract has been arranged for another camp with a Rural Electrification Administration co-operative obtaining power from a private company. Several other contracts with utilities are in negotiation and officials are confident that private companies will take on the work. Where arrangements cannot be made speedily with private firms, however, the Army is ready to accept the R.E.A. offer to organise a co-operative to put up the necessary lines. There also has been thought given to installing Diesel generating units at the camps, but delays in getting deliveries make this impracticable.

The Army has no funds of its own for bringing utility lines to the camp sites, so that all construction costs must be borne by the power supplier. The first contracts provide that the Army takes its power at the camp boundary at about 13,000 V. Exact rates for any contract are not available, but the average is 1.1 cents per kWh. Contracts are for a single year, but they will be renewed annually as long as the conscript army training programme continues. The question has not come up in negotiations, to date, but the Quartermaster's officials believe that utilities could obtain the required certification for a five-year tax amortisation of investment which they have made in these lines if desired.

It is estimated the Army will need a demand load of 1,000 kW for each 10,000 men in a camp and that the camps will use that much load about 200 hours monthly. Rates are calculated on both a demand and use basis.

A new camp near Alexandria (Louisiana) will be served jointly by the Louisiana Power & Light Co. and the Louisiana Ice & Electric Co. from a transmission line which had been contemplated in the companies' long-range development programme, but instead will be built now for national defence.

INSTITUTION PROCEEDINGS

Grid Metering Methods. The Space-Heating Art. Measuring Noise

Metering Grid Supplies

THE functioning under commercial conditions of the metering equipment associated with the national interlinking grid system is the main subject of the inaugural address prepared by Mr. C. W. Marshall (Central Electricity Board staff) as chairman of the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS.

The power supplied to the grid (peak load) in 1939 was 7,000 MW and the energy generated during that year was 21,000 million kWh. Approximate measurements of the associated reactive components were also made in order to determine the power factors required for assessing the supply costs according to the Electricity (Supply) Act, 1926.

The success of the efforts of the principal British manufacturers to improve the accuracy and reliability of polyphase kWh meters may be judged, Mr. Marshall points out, from the fact that after ten years' service the grid meters continue so to function that their registrations are almost invariably accepted without question by every authorised undertaking in Great Britain. So far there has not been any call from outside parties for independent checking of the grid meters, but the Central Electricity Board has taken the precaution of submitting sample meters of all types to the National Physical Laboratory (the ultimate tribunal of reference) for resetting after long periods of service. They are still registering well within the originally prescribed error limits; the maximum absolute error in registration within their working range of load and power factor is of the order of plus or minus 0.5 per cent.

Specially-developed Apparatus

Integrating meters form the initiating elements of a chain of units which finally provide the Board's accountants with data from which to prepare their statements of supply costs. The remaining major elements of this chain are the summating system, long-scale maximum-demand indicators, and maximum-demand printometers. They were all specially developed to meet the requirements of the 1926 Act. There is no independent tribunal to pass judgment on them, but they have been subjected to the continuous critical examination of the metering engineers of the authorised undertakings, who are unlikely to have missed any technical weakness in the measuring system. The equipments have survived that examination with credit.

There is no technical reason why these components, which, incidentally, are subjected to more onerous stress conditions than the integrating meters, should not continue to perform their destined functions for the statutory life period and beyond it; but, apart from the everyday hazards to which all persons and equipments are now being subjected, there are indications that the metering system may be modified, or even replaced, for reasons other than technical obsolescence.

For electricity supply accountancy in general, and selected station costs in particular, the correlation and analysis of meter readings is an involved and tedious process. An alternative is to use the integrating meters to perforate cards from which the requisite records can subsequently be compiled by means of mechanical accounting machines. Within recent years, this scheme has been revived from the accountancy end and the perforated card process of translating electrical records into costs is being carried out in calculating machines. The next step will probably be to revive and realise the scheme of perforating the cards directly on the basic meters. The possibility of the mechanisation of meter reading is potentially applicable to all meters.

Passing on to the instruments used for routine operating purposes, Mr. Marshall reports that indicating equipments have served their purpose in an entirely satisfactory manner. With these instruments, as with integrating meters, there is little scope for technical advance. It is, however, possible to effect considerable improvement in rationalising, for conservatism has perpetuated the use of large instrument control boards in spite of the fact that the advantages of miniature instruments have already been demonstrated in a few power stations. There should be a departure from convention and a trend towards the much more elegant, compact and economical arrangements used in aircraft and road transport vehicles.

A minor detail which merits consideration in the interests of economy is the scale form. The adoption of decimal or percentage scales would eliminate the need for differentiating between voltmeters, ammeters, and wattmeters, and would simplify considerably the procedure for using instruments in conjunction with current and voltage transformers.

The service performance of protective gear, of a type previously unknown in British practice, for obtaining selective clearance of faulty sections of line within periods of time comparable with those required for clearance by balanced pilot protective gear, may be assessed from the fact that 90 per cent. of all faults are cleared discriminatively.

Circuit-breakers have been greatly improved in respect of speed and consistency of operation under fault conditions. Relay engineers have, therefore, had an important and troublesome variable eliminated from their problem of securing accurate discriminative clearance of faults. The pilotless systems of protection adopted on economic grounds in conjunction with modern circuit-breakers can, therefore, give a closer approximation to the performance of the simpler, but more expensive, current balance systems. Pilotless protective schemes are, nevertheless, inherently incapable of the highest degree of discriminative action, and a reversion to the unit system of protection is in progress. Interlock protection, using carrier current control with the power lines themselves as pilots, is now being applied to many new high-power transmission lines. The result is that a new class of specialists is beginning to be formed who concern themselves with such matters as calculation of fault currents, and design and application of power relays, and of carrier current equipment. The mental qualities required for such work are of an exceptionally high order, and the degree of competence is subjected to absolute test by the manner in which the equipment for which they are responsible functions to maintain continuity of electricity supply. War has made protective action commonplace and has brought into clear relief the excellent work done by the field staff in keeping the protective gear ready for all emergencies.

Mr. C. W. Marshall

To improve on the 90 per cent. already attained would involve excessive capital expenditure. Probably higher efficiency will be obtainable by utilising quantitative records of fault phenomena to trace reasons for non-discriminative actions. Automatic recording apparatus is gradually being fitted to all sections of the grid, whereby the necessity of synthesising fault phenomena from relay operations and calculations will be eliminated. Such records are, in addition, valuable as a means of locating faults and so assisting everyday operation by making it possible for repair squads to proceed directly without preliminary location by patrols. This country has, to some extent, lagged behind others, particularly America, in the development of the necessary instruments for the purposes described, but it is now rapidly producing instruments in line with its own needs and resources.

Grid "Observatories" Visualised

Mr. Marshall anticipates that the future will see the establishment of many analysing centres where all abnormalities of the national electricity supply will be investigated. Such centres would be analogous to meteorological observatories and would have, in addition to the work of recording transient electrical phenomena associated with faults, that of analysing them and indicating how system operation may be improved.

The production, measurement and control of impulse voltage waves for testing the ability of electrical apparatus to withstand lightning stresses is now in advance of the design of lightning protective equipment, in Great Britain at least. There is an understandable tendency to accept the situation as satisfactory for the present and to leave the securing of further improvement to a few experts. They are now being called on to produce lightning protective devices in accordance with the economical

and technical needs of the case. There are good reasons to anticipate that such devices will soon be available for commercial use.

Some slowly acting associated phenomena are liable to be forgotten in the stress of war, particularly deterioration of insulation. By determining the voltage gradient along chains of line insulators or sections of post insulators it is easy to locate faulty units, which can be replaced and the factor of safety restored to its original value at comparatively small cost. In the case of fibrous insulation, capacitance and dielectric losses can be conveniently measured; by specially sensitive indicating wattmeters or the Schering bridge comparison at intervals of normal service, it is possible for experienced technicians to distinguish when insulation is deteriorating and to tell when it must be removed if breakdown in service is to be avoided. In this field of what may be termed "insulation pathology" there is much scope for precise measurement. Mr. Marshall hopes that it will not be long before all electrical plant maintenance is based on quantitative measurements of critical characteristics rather than on arbitrary intervals of time established for the most part by expediency.

Electric Space Heating

FACTS and fallacies relating to electrical space heating installations were discussed in a long paper by Mr. Ronald Grierson which was read in London on December 14th before the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.

Mr. Grierson commenced by recalling fundamental principles of physics, explaining that in order to acquire dexterity and speed in the art of manipulating the various units of measurement one must be absolutely sure of the foundations on which they were based. He had himself found it convenient to cultivate the faculty of manipulating the various constants in terms of British thermal units, but to convert them to electrical units before completing calculations relating to space heating installations.

Next followed a differentiation between "weight" and "mass," with a warning not to overlook the vitally important factor of the gravitational force influencing the rise and fall of "fluid" (air and water) according to temperature changes. The motive force, provided by gravity, lay in the cooler (heavier) medium which therefore forced the warmer (lighter) out of the way. Cold down-draughts were the cause, which had to be provided for; ascending columns of warm air were the effect, which must be visualised.

The application of theory to practice was demonstrated by a consideration of window draughts, typical air volume and heating wattage calculations indicating a very definite reason for placing sources of heat energy under the windows. If they were placed on the side of the room remote from the windows, cold window draughts would descend unchecked to the floor and accelerate the rate of displacement of the heated air stream, thereby intensifying the temperature gradient in the room, *i.e.*, the ratio of the temperatures at ceiling and floor levels. With a narrow heater under a wide window the ascending column of warm air over the heater would be flanked by two descending columns of chilled air. Preferably the heater should overlap the width of the window by a minimum length of 6 in. at each end. For this reason low and wide heaters were usually in more general demand than high and narrow types.

"Futile" Installations

The author's objection to heaters designed to discharge relatively small volumes of air at high temperature was based on the relationship between air temperature and weight per cu. ft., in view of the reluctance with which heated and cool air mixed and also of the velocity with which warm air was forced upward through the surrounding cool (still) air. The performance of devices that transmitted their heat energy in the manner of the suburban chimney on a cold, windless day was subnormal; installations designed to drive warm (light) air down into pools of cool (denser) air were equally futile.

Mr. Grierson mentioned several examples of the performance of work in the overcoming of resistance of differing kinds, all at the expense of the kinetic energy possessed by the moving bodies by virtue of their motion. The net result was low-grade heat energy that in some cases constituted "thermal litter," the removal and disposal of which was often a very real and costly problem. The author devoted a considerable amount of time to this subject of energy conversion, for in it lay the full and complete explanation of the remarkable and unexpected economy of energy consumption registered by efficiently designed electric space heating installations that were effectively controlled by accurately adjusted thermostats and time switches. Electrical energy was only one of the several forms of heat energy that entered a room, or building; and the periodic, or seasonal, consumption registered by the meter depended very largely upon the percentage of the total work that it performed.

From both the convenience and economical aspects rapid thermal acceleration was of vital importance in the case of intermittently warmed buildings, or rooms only used for a few hours on odd days. Several ways of allowing a margin of power to provide the desired acceleration of temperature rise during the major part of the heating season were mentioned in order to illustrate the effect of the increase in accelerating force (kW loading) on the time occupied in attaining the scheduled operating conditions.

The somewhat unorthodox method of treatment adopted in this paper, with its many apt and sometimes entertaining similes, which completely exhausted the 5,000-word ration allocated to the purpose, was an endeavour to show that the art of space heating, which appeared to be elusive and imponderable, not easy to comprehend and still more difficult to manipulate, when accorded its correct treatment as "energy" rather than "heat," became a logical and tractable process, comparable with other branches of engineering and governed by the same laws.

Noise Measurement

THE operational principle, design and performance of an objective noise meter (reading in phons) for sustained sounds, with special reference to engineering plant, are described in a paper just released by the INSTITUTION OF ELECTRICAL ENGINEERS.

Its authors, Messrs. A. J. King and C. R. Maguire and Drs. R. A. Scott and R. W. Guelke (the last-mentioned having since gone to the University of Cape Town, South Africa) conducted their investigations in the research department of the Metropolitan-Vickers Electrical Co., Ltd. They state their reasons for considering objective measurement to be more desirable than subjective, but emphasise the importance of the former's reading being in accord with the latter's standard, which is the phon. The limitations of the conventional objective instrument (corresponding to the American sound-level meter) are discussed and a new principle of noise measurement, involving a correction to be added, is described. The derivation from peak and RMS (sum of equivalent 1,000 c/s pressure amplitudes) is explained, both ideally and practically.

Method of Checking

Substantiating performance figures are included, the evidence being that the instrument will measure simple and complex noises of many types which persist for 10 seconds or more with a mean error of less than three phons. The fact that it incorporates summed-energy and peak meters means that the readings of these meters on any noise are available for comparison purposes if required, but the process which has been described of deducing from these two readings a correction dependent on the complexity of the noise, yields, in most cases, a more accurate value for the equivalent loudness of the noise. The performance of the meter has purposely been checked on noises which experience has shown to be difficult from the point of view of objective measurement in phons, and so in many practical cases the errors will be less than a mean of 2.7 phons. This performance extends from 30 phons up to as high as available subjective data warrant the use of the word "phon," but certainly up to 100 phons.

For noises of over 105 phons the realization of the standard reference conditions becomes increasingly difficult, and for 110 phons and above the indications are that the S.E. (sum of the energies) readings are substantially correct. The range can be extended downwards to 20 phons by providing sufficient amplification with the specially sensitive microphone. The addition of more complicated phase-changing apparatus does not appear to be justified. The apparatus is self-contained, readily portable and easily and quickly operated.

Possible detailed improvements in design are suggested; finality is not claimed, since the principle described may be made effective in other ways, which may be better. For instance, the type of peak meter utilised is deemed adequate for most

practical harmonic noises, but it is possible that with certain non-harmonic noises in which the maximum peak occurs infrequently the reading obtained may be somewhat low. The extra complication of making the meter direct-reading by introducing the correction automatically is hardly worth while. The instrument's dimensions are 16 in. by 10 in. by 10 in. and its weight with batteries is 35 lb.

Colliery Pumping

SOME recent applications of centrifugal pumping machinery were the subject of a lecture illustrated by lantern slides that was delivered at Cardiff on December 7th before the South Wales branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS by Mr. R. E. Fortune, a member of the West Wales branch.

The lecturer expressed his considered view that the electrical engineer of a colliery company was more ready to appreciate the value of the fundamental theoretical considerations than his mechanical colleague. There was also a growing tendency to entrust the electrical engineer with the choice of pumping plant which was essentially a combined electrical-mechanical unit. A possible explanation might be that technical electrical thought was peculiarly akin to pump design. A failure or breakdown, inconvenient as its results might be, should provide an opportunity for trouble diagnosis. Only small-minded engineers with an inferiority complex were fearful of admitting failure.

Dealing with would-be purchasers, Mr. Fortune said it was common experience to find that they severely "rationed" the amount of information they submitted with the initial inquiry.

The differences between the centrifugal pump of thirty years ago and its modern counterpart were small, but they existed. They were due to methods of manufacture, the results of competition and also of metallurgical research. Output for output, the modern pump was lighter, ran at a higher speed, and for factors of ignorance there had been substituted more or less well-known factors of safety. If there had been a tendency towards "slimming" to meet the voracious appetite of the price buyer, it could truthfully be said that the metal was better placed and of superior quality.

The conservative attitude of the mining engineer was and still remained easily explicable. The safety of the mine was his first and only consideration. Courageous pioneering might in his case sometimes be termed foolhardiness. It was twenty years after their introduction that a borehole pump was supplied to a South Wales colliery.

Supply Authorities' Problems

Recent I.M.E.A. Activities

THE reluctance of Government Departments to consider the installation of electrical apparatus in their buildings is discussed in the December *I.M.E.A. Journal*. It is stated that last February the Joint Committee of Electricity Supply Associations considered representations which had been made regarding this matter and instances were given where War Office specifications for buildings precluded the consideration of electric cookers and wash-boilers. It appeared from these and other similar cases that the War Office and Office of Works officially recognised electricity for lighting purposes only.

The attention of the Electricity Commissioners was drawn to the undesirable discrimination shown by Government Departments in this connection. The Commissioners replied that they were taking action with the appropriate Departments to prevent discrimination against the use of electricity. The *Journal* says :—

"We do not know what effect this has had. We have been informed that Corps Routine Order No. 343, dated October 7th, in effect prohibits the use of electricity or gas for any purpose other than lighting, on the assumption that either electricity or gas is too dear. It is believed that this Order goes further by preventing any enquiry being made as to the relative cost of this service against any alternative method of heating and cooking.

"It is a pity that certain Government Departments are evidently prejudiced against the use of electricity for purposes other than lighting, on the score that the cost is high, and it is time that these Departments or the persons responsible for the specifications were fully informed as to the relative merits of gas and electricity for all purposes. When Government Departments are dealing with public funds, the electricity and gas industries should at least be given an opportunity to compete with other forms of heating, and not be excluded from specifications on the assumption that they are too expensive."

War Damage and Electricity Agreements

The War Emergency Committee of the I.M.E.A. has considered a communication on the effect of war damage on agreements embodying guaranteed minimum consumption clauses. Usually power supplies under contract are given in accordance with an agreement containing a clause providing for the payment of an annual minimum sum, or for the payment for a minimum number of units per annum during the period of the agreement. In the case of small power consumers taking supply under the ordinary published tariffs, *i.e.*, not special agreements, there is very often also an agreement to pay a minimum annual sum, or for a minimum number of units per annum for a given period in order to cover the cost to the undertaking of special expenditure on services or extensions to mains.

A consumer who is taking supply covered by a minimum payment agreement, can terminate this agreement forthwith in the event of his premises being so damaged by enemy action as to render it impossible for him to take any supply whatsoever, or only a partial supply, always assuming, of course, that the undertaking is in a position to provide him with the full supply covered by the terms of his agreement.

Damaged Hire-purchase Apparatus

Some members of the Association are in doubt regarding their position when apparatus supplied on hire-purchase terms on consumers' premises is damaged by enemy action and whether they can claim compensation.

The Association's solicitor points out that the obligations ordinarily imposed upon the hirer to insure against loss or damage, to repair or replace the goods, to continue payments after the goods have been lost or damaged or to pay damages or compensation do not extend to loss or damage by war.

Undertakers apparently have the right to remove apparatus belonging to them from houses which have been damaged and vacated if payment for the goods has not been completed. The question of recovery under the agreement is one which must be decided by the legal adviser to each authority, and although there may be right of action, it is doubtful whether any Court would in any way penalise the hirer in view of the abnormal circumstances. It is difficult to generalise, as the merits of each case might differ very widely.

In the War Damage Scheme drafted by the Joint Committee of Electricity Supply Associations, provisions have been incorporated for ascertaining the measure of loss of authorised undertakers by reason of war damage in the several cases of damaged works which have been replaced, damaged works which have been repaired and damaged works which have not been replaced or repaired. The expression "damaged works" is defined by paragraph 2 of the scheme, and would cover hire-purchased goods. The scheme also provides for the payment of the amount of the measure of loss. This does not apply to property which is otherwise insurable against war risks.*

Assistance for Undertakings

The Joint Committee of Electricity Supply Associations has had under consideration representations made by certain undertakings for financial assistance due to evacuation of consumers from their areas. The matter was discussed with the Electricity Commissioners who were obtaining information for submission to the Joint Committee. The Association addressed a communication to a number of towns with a view to ascertaining the position, and from the information received, it was apparent that no action was necessary at the present time.

* Special provision for the insurance of hire-purchased goods are made in the War Damage Bill which is summarised on page 160—EDITORS, ELECTRICAL REVIEW.

HIGH-EFFICIENCY FLUORESCENCE

Its Nature and Employment

By T. Thorne Baker

There are great possibilities in fluorescent lighting. In this article the various agents and their production are described and the way in which they produce their effects is illustrated

THE utilisation of the property of certain substances to absorb radiation of one wave-length and to convert it by fluorescence into radiation of more useful wave-length visually is rapidly becoming an essential feature of illuminating engineering. Photometric data which make it possible to treat luminescent paints and lacquers as items of illuminating engineering equipment have recently been determined by Harper, Robinson and Bowtell. Three years ago Schouwstra and Zecher gave particulars of a low-pressure mercury vapour lamp surrounded by a coating of fluorescent material which had an efficiency of 30 lumens per watt, and the tubular lamp recently introduced has reached 35 lumens per watt.

In an address given to the Institute of Physics at Leeds last year Dr. C. C. Paterson (director of research, G.E.C.) stated that when research workers learnt the way to make practical light sources through gases and vapours they could not ignore the enormous yields of light so obtainable for the electricity consumed; gaseous sources of electric light gave upwards of three times the amount of light for the same electricity costs. A low-pressure mercury tube, he stated, when coated internally with a green fluorescing silicate increased the light output some eight or ten times. The attraction to the research worker has always been the expectation that if all the invisible radiation emitted by such a lamp could be converted into *visible* radiation, the luminous efficiency from the combined radiation would be greatly increased.

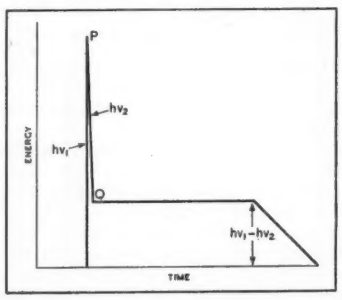


Fig. 1

Stokes first recognised that in fluorescence there was a transformation of the incident radiation into radiation of a different frequency, and he enunciated the law that if the fluorescent light is emitted by a system vibrating at its natural period, the frequency of the exciting light is always greater than that of the fluorescent light. This law completely blocks the way to the intriguing idea of converting the immense proportions of infra-red emitted by incandescent lamps into usefully visible light of higher frequency.

One of the most useful applications of fluorescence is to the so-called intensifying screens employed in radiography since about 1910. A layer of calcium tungstate coated on a suitable support is placed in contact with the photographic film during its exposure to the X-rays, and on excitation fluoresces with a vivid bluish-white light which is approximately five times more actinic on the photographic film than the X-rays themselves. The average wavelength of the X-rays is about one four thousandth that of the visible blue rays emitted by the tungstate, so that in this case an immense increase in wavelength is involved in the phenomenon of fluorescence.

The exciting radiation must fall within a critical absorption band, and in the case of the quartz mercury vapour lamp, in which the mercury radiation extends in the ultra-violet to about 225 μp, (2250 Ångstroms), the change in wavelength is markedly less. Absorption of the ultra-violet by zinc sulphide, one of the best known "phosphors," results in the production of greenish-yellow fluorescence, embracing a spectrum band somewhere between 500 and 600 μp. If all the energy in the mercury vapour discharge could be converted into light of the brightest visual colour (555 μp.) its luminous efficiency would be more than 600 lumens per watt. This is the tempting goal towards which many are striving.

The actual phenomenon of fluorescence may be indicated by a simple diagram (fig. 1) representing an electron from the activating source (such as the ultra-violet radiation from a mercury vapour tube) striking a molecule of the fluorescent compound (zinc silicate, for example). A sudden jump in energy level to a point P is the result; the energy imparted may be $h\nu_1$. The instability of the molecule, an essential feature of fluorescence, causes it to give out some of the suddenly acquired energy, and the level drops to Q, representing a loss of the quantity $h\nu_2$. The residual energy $h\nu_1 - h\nu_2$ represents the persistence of fluorescence, or phosphorescence, which decays exponentially, and varies enormously with the type of treatment of the fluorescent substance.

It will be readily appreciated that in the case of fluorescent coatings of television screens in cathode tubes the decay must fall below the limits of the persistence of vision, otherwise one image would run into the next and ruin definition. In lighting problems, on the other hand, fluorescence and phosphorescence can be advantageously present together.

A special case of phosphorescence is the calcium sulphide known as luminous paint, which when excited by daylight may phosphoresce for several hours afterwards. A mixture of 100 parts of calcium carbonate and 30 parts of sulphur is heated to redness for an hour or two, after contamination with about 1 part in 10,000 of basic bismuth nitrate, the latter being a necessary attribute of the phosphorescence and known as a phosphorogen. Substances, such as zinc sulphide, zinc silicate, cadmium tungstate, etc., are first of all prepared in an extremely pure state under strict chemical control, and very minute amounts of the necessary phosphorogens are introduced; without them, as indicated, the substances would be inactive. The prepared material is then heated to a high temperature, the range being somewhere between 800 and 1,200 deg. C., when the substance assumes a definitely crystalline character, which is sometimes assisted by the introduction into the firing furnace of an inert gas or a gas which plays some part in the morphological change.

Different phosphorogens are capable of causing considerable modifications in the hue of the fluorescent light. Levy and West and others have succeeded in producing a range of compounds emitting light of practically all broad spectral colours by employing different metallic salts together with the use of specific phosphorogens, and this has been the means of predetermining the colour of the complete lamp, to which reference is made below.

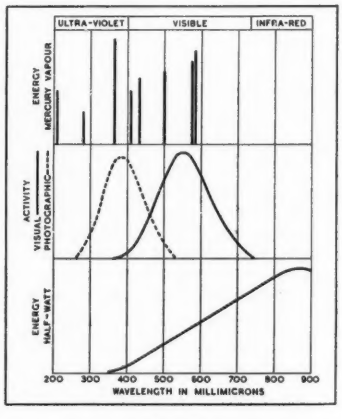


Fig. 2

The manufacture of phosphors for electric lighting purposes has been developed markedly in recent years, as the Patent Office records will show. The activities in research increase year by year. The result of the work to date is that it is possible to produce fluorescent light with primary energy derived from mercury vapour tubes which is practically the equivalent of daylight. In fig. 2 an endeavour has been made to indicate the output of mercury vapour, which consists of a number of narrow but intense spectral lines, as against the continuous spectrum of incandescent light, which begins in the near ultra-violet, between 300 and 400 millimicrons, and extends a long way into the infra-red, the maximum being reached between 800

and 900 μp. Between the two energy diagrams is seen the visual luminosity curve for *daylight*; the activity to the human eye is greatest at about 555 μp.

While the mercury vapour spectrum contains lines in the visible portion, it contains powerful lines in the ultra-violet, and it is these which are converted by the phosphors into light of the visible spectrum. The dotted curve indicates the active part of the spectrum in the case of ordinary photographic material, *i.e.*, *not* panchromatic plates or films. An immense amount of this "colour-blind" photographic material is used, and those engaged in fluorescence research seem to have overlooked the very high photographic efficiency that would be possible in a fluorescence lamp the phosphors of which emitted light corresponding to the dotted curve, or photographic response.

Commercial lamps are made in the form of a mercury vapour tube 5 ft. in length and 1½ in. in diameter, and are made for 200/220 V and 230/250 V AC. Their loading is 80 W and their initial light output is 2,800 lumens. As their normal temperature rise is only 25 deg. C. these lamps are the means of obtaining for the first time in the lamp industry high levels of daylight quality illumination without discomfort from heat. That smaller sizes will follow may be taken for granted.

Considerably smaller examples are in general use in the United States, where tubes about 2 ft. in length mounted in a metal desk or bench stand, the under part of which contains the auxiliary gear, are very popular. Daylight fluorescent light has been largely adopted in that country for laboratories engaged in natural colour photography and by colour-printing establishments. Mounted round the copyboard for commercial photography of drawings, plans and artists' sketches they make an ideal illuminant owing to the excellent diffusion of the light. In the motion picture studio they also make it possible to light up dark spots in a set absolutely free from shadows and, owing to the daylight character of the light, they can be mixed indiscriminately with other "daylight" units, such as "straw" filtered arcs and blue-filtered 3,200°K photographic incandescents.

The low surface brightness of under 6 candles per sq. in. makes complicated shielding of the light source unnecessary. Fluorescent light is thus proving of considerable value in the lighting of benches and machines and various types of precision work for which a high illumination level of diffuse character is desirable.

How much farther can we go, one may ask, towards maximum lumens per watt efficiency? Experiments indicate that phosphors can be made to yield considerably increased long-wave radiation for ultra-violet energy absorbed, but that this increase is not likely to be phenomenal. It is one way, however, along which further improvement may be looked for. Increasing the richness of coating is limited by the fact that as soon as an optimum amount has been applied, the material absorbs the very rays that are needed to make the outmost layer fluoresce. While large crystals of the phosphor are known to give most light, it is not easy to prepare them with a larger diameter than a few μ, and in a mixed bake containing some very large crystals, these if sieved off and crushed to a suitable powder are actually less efficient than small crystals of corresponding size.

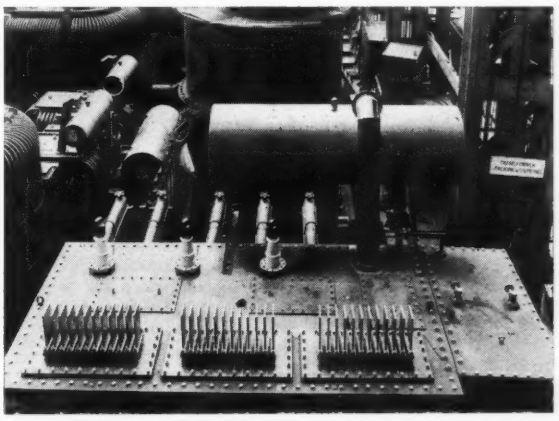
Some progress will be contributed to the problem, probably, by the work being done in the direction of improved transmission of the glass for mercury tubes, of which some description was given in a recent communication to the Society of Glass Technology.

Electric-Furnace Transformers

Close Control of Input

IN most arc furnaces maximum energy input at higher voltage is required for from 1½ to 2 hours to bring a cold charge to a molten state. As the cycle proceeds the heavy energy input declines and refining, if carried out, necessitates a comparatively small input at reduced voltage for from 4 to 7½ hours. During the melting period, reactance of as much as 50 per cent., either in the form of a tapped reactor mounted in the tank or as a separate unit, may have to be switched in.

As heat generated in excess of that absorbed by the charge causes rapid deterioration of the furnace lining and roof, close control of the energy supplied must be obtained by adjusting the length of the arc and by altering voltage tappings on the transformer. As heat can be maintained in the furnace, tap-changing on load is unnecessary. The range of secondary voltage required is about 60 per cent. for a steel-melting furnace and 30 per cent. for a carbide furnace. Usually the power required can be reduced in proportion to the secondary voltage, which can be varied by changing the primary windings from delta to star.



Tank cover of 7,500-kVA arc-furnace transformer showing oil-tight glands fitted to l.v. terminal bars

Resistance furnaces are used for processes requiring a constant temperature or a slow temperature cycle (*e.g.*, heat treatment and annealing), the heat being generated by resistance units of special alloy or in certain cases by the resistance of the charge itself. Constant current (not constant kVA) is therefore required and in many cases voltage adjustment is infrequent. This is carried out by tapping boards or a manually operated off-circuit tapping switch.

When a furnace includes a number of heat zones, the heating units in each are separately supplied by low-voltage transformers fed from a high-voltage mains-connected transformer. The relative temperatures of the various zones are then adjusted by tapping links on the low-voltage transformer, while the temperature cycle of the furnace as a whole is controlled by primary tappings on the main transformer. Off-circuit tap-changing equipment provided for furnace transformers made by the British Thomson-Houston Co., Ltd., is in effect "on-load" gear especially adapted to furnace conditions.

Where constant kVA output or on-load tap changing is essential the delta-star primary cannot be adopted and the physical size and cost of the transformer is increased in proportion to the ratio of maximum and minimum secondary voltages. When secondary currents exceed 2,500 A, delta-connected windings are preferable to obtain the minimum winding current and maximum number of turns per phase.

For small resistance furnaces, naturally air-cooled dry transformers are regarded as probably the best. Their higher cost is offset by lower fire hazards enabling them to be placed near the furnace. Non-inflammable "Permitol" liquid dielectric provides an alternative. Oil-immersed self-cooled transformers are usually employed for larger resistance furnaces and for all arc furnaces up to 5,000 kVA. Above that figure (or less where space limitations are a factor) forced-oil circulation with water cooling is advised. The B.T.H. Co. employs a tank-mounted glandless oil pump, with a driving motor immersed in the oil for circulating the oil from the top of the tank to the bottom *via* a heat exchanger.

Oil conservators with magnetic oil gauges, although adding appreciably to the cost of heavy-current units, are recommended, together with maximum reading pointer and alarm contacts on the larger sizes. Where conservators are provided Buchholz devices can be fitted to give protection against internal faults.

WAR DAMAGE INSURANCE

Details of Government Scheme

LAST week the text of the Government's War Damage Bill was published. Copies can be obtained from the Stationery Office at 1s. each. The Bill is in four parts. Part I provides a compulsory contributory scheme of compensation for war damage to buildings and other immovable property (including fixed plant and machinery). Part II institutes a compulsory scheme of insurance of all the movable assets of business undertakings (movable plant and machinery, office and shop equipment, etc.) and a voluntary scheme for personal "chattels" (furniture, clothing, etc.). Part III makes certain amendments in the existing law relating to the War Risks Insurance Scheme for Commodities. Part IV deals with miscellaneous and general matters.

For the administration of Part I a new body, the War Damage Commission, is to be set up; it will be assisted by the Valuation Office of the Inland Revenue Department. Contributions will be collected by the Commissioners of Inland Revenue.

Compensation payments will be of two kinds. The first, "cost of works" payments will in general represent the actual current costs of repair. If, however, such costs would exceed, in the case of a building, the value of the building when repaired, or, in the case of land, the depreciation in its value as the result of the damage, then a "value" payment will be made. This will be equal to the difference between the values of the property immediately before and after the damage on the basis of prices current at March 31st, 1939. In the case of properties which are made good in the national interest a "cost of works" payment may be made, notwithstanding that it exceeds the stipulated limit.

Provision is made for payment for immediate repairs to essential properties and "first aid" repairs to houses and other properties and generally the time of payment will be determined according to the national interest and will depend primarily upon the supply and availability of labour and materials. "Cost of work" payments will be made as and when the repairs are carried out; "value" payments will be made at such times as may be directed and in the meantime interest at 2½ per cent. will accrue to be paid with the compensation.

Rate of Contribution

Contributions will be payable in respect of each property; they will be based upon the Income Tax Schedule A net assessment or otherwise upon the net annual rateable value. The amount paid will be five annual instalments of 2s. in the £ of the annual value; there are special terms for agricultural and recreational properties. Payments will be due on July 1st of each year.

It is anticipated that a total of £200,000,000 will be raised by this means and payments from the fund thus created will cover a "risk period" beginning on September 3rd, 1939, and ending on August 31st, 1941, *i.e.*, the scheme will be largely retrospective. Should the aggregate payments from the fund exhaust it the excess will be borne by the Exchequer up to an amount equal to the aggregate receipts. If the receipts fall short of the payments contributions may be increased in amount or number; conversely if the payments are exceeded by the receipts, the latter may be reduced "as Parliament may determine." Payments of contributions may be made in advance when interest at 2½ per cent. will be paid.

Public Utility Undertakings

Special provision is made for public utility undertakings to receive payments on account to finance the repair of war damage. These undertakings are to be the subject of further legislation which, after consultation with them, will shortly be brought before Parliament and in which provision will be made for the payment of contributions and the basis of compensation.

The schemes embodied in Part II of the Bill will be administered by the Board of Trade. Premiums will be collected and policies issued by the Fire Offices and Lloyds, acting as the Board's agents. The Board will make Orders giving effect to the schemes.

Under the "business scheme" an owner of insurable property valued in excess of £1,000 will be required to insure for the full value of the property. Any other person *may* insure for the full amount. Compensation will be paid at such times as may be directed and will be paid during the war where the amount does not exceed a sum to be fixed and the Board of Trade is satisfied that replacement or repair is expedient in the national interest. Where compensation is deferred interest will accrue at 2½ per cent.

The rate of premium is to be 30s. per cent. in respect of the war period to the end of September, 1941, and in order to spread the charge separate policies will be issued for each of three successive periods ending on or about that date. The professions will come within the business scheme.

The premium under the scheme for the voluntary insurance of private chattels will also be at the rate of 30s. per cent. and annual policies running for a year from the date of issue will be employed. Immediate compensation will be paid up to a limited amount and the balance, except in cases of hardship, deferred until such time as may be directed, with interest accruing at 2½ per cent.

It is provided that the maximum amount insurable under this scheme shall be £1,500, plus an amount not exceeding £500 in respect of a motor car or motor cycle. The present scheme of compensation for persons of limited incomes is to be continued without payment of premiums.

The Board of Trade is empowered to make payments where damage has occurred before the coming into operation of the schemes. Compensation will be assessed on the same basis as under those schemes and will be paid in the same way subject to an appropriate deduction in respect of insurance premium. Premiums under the two schemes will not be allowed as an expense for the purpose of income tax, national defence contribution or excess profits tax.

A prohibition is placed upon mutual insurance schemes for war risks insurance except in respect of property not covered by the present Bill or the War Risks Insurance Act, 1939, or goods which, though otherwise falling within the commodities insurance scheme, are not compulsorily insurable under that scheme.

Hire-purchase Goods

Part III of the Bill amends certain provisions of the War Risks Insurance Act, 1939, relating to the insurance of commodities. Under Part II of the Act the Board of Trade was able to exempt certain classes of goods from insurance but not to make insurance of such goods voluntary. This position is now straightened out and voluntary insurance may be permitted.

It is proposed that goods supplied under hire-purchase agreements should become insurable under the commodities insurance scheme and that the power to make goods voluntarily insurable under the scheme should then be exercised in respect of goods supplied under agreements concluded after the date when the present Bill becomes law. Goods supplied under earlier agreements will be made insurable voluntarily under the "business scheme."

Receipts from premiums under the "business scheme" to the end of September, 1941, are expected to be about £25,000,000, but no estimate can be made of the probable amount of compensation which will be payable or the expenses of administering the scheme. It is also impossible to state what premiums will be received or payments made under the "private chattels" scheme.

Induction Heating of a Dam

AS the eleven drum gates (each 115 ft. long by 28 ft. high) used to control the reservoir water level at the Coulee Dam power station, Northern Washington, may have to operate at temperatures down to 28 deg. F. below zero, it has been necessary to provide means of preventing ice accumulation and freezing of the gates. An article by R. D. Goodrich, in *Electrical West*, describes the induction heaters adopted for the purpose. AC is passed through a conductor threaded through holes in the ironwork and 78 per cent. of the heat is developed in the iron. Each of the gates requires 215 kVA to prevent freezing. Power is supplied from twenty-two 6,900/50-V transformers (two per gate). Seven 2½ per cent. primary taps are provided. Overheating of the neighbouring concrete is prevented by thermostatic trips which operate when its temperature reaches 125 deg. F.

POWER IN WARTIME

The Provision of Emergency and Short-term Supplies

By V. A. H. Clements, A.M.I.E.E.

AMONG the many problems which modern warfare brings to electricity supply undertakings, not the smallest is the pressing need to make available more, and still more, supplies of electricity at continuously greater speed. The necessary quantity of generating plant has been admirably provided over past years by the large station owners, while the grid ensures to some extent that the output from the stations is available in the areas in which it is needed. Similarly transmission and distribution systems have, especially in the case of the larger undertakings, usually been laid out with a substantial margin to spare and thus the backbones of both national and regional electricity supply are sound and capable of dealing with the demands likely to be made upon them. In parenthesis, the lighting restrictions have of themselves freed quite a substantial part of the national generating and transmitting capacity for more important purposes.

It is, therefore, the detailed services which have now to be attended to, for the new factory (whether needing only a few horse-power of motors or many thousand), for extensions of existing factories or, just as often, for the increase in demand due to busier conditions from connections already existing. The last-mentioned increase is in some instances remarkable and, apart from motive power, it can be foreseen that, with the standards of lighting now, not before time, being pressed upon factories by the Government authorities, very considerable further increases will soon arise, and will gather speed for the next twelve months at least; this alone will probably use up the spare capacity brought about by the lighting restrictions, but, it must be noted, the demand therefrom will be shifted from cables and substations supplying street lighting, shops, places of entertainment, etc., to those parts of systems supplying factories and workshops.

The author maintains that a relaxation of peacetime standards is justifiable for wartime power supplies and that it is reasonable to expect the consumer to bear a greater proportion of the capital cost

This redistribution of load, when added to other factors, such as evacuation, is of itself a source of anxiety and needs constant watchfulness; it is to a large extent mitigated in the case of authorities with extensive systems who have the facilities for maintaining complete statistical records and for constantly watching the position and who can, to some extent, change and exchange substation equipment to deal with altered conditions.

Using up Stocks

A further advantage gained by the larger authorities is by way of the stocks of apparatus, including in many cases motors and control gear, which they keep in normal times as a measure of security for their consumers. While in wartime these stocks become depleted, the fact of depletion implies that they have rendered noteworthy service in reducing to a minimum delay in the operation of some vital machinery at consumers' works. In one instance it is known that a large new works has obtained a supply of several thousand kilowatts immediately instead of waiting many months for the delivery of substation plant.

The provision of wartime services needs a new consideration of the general facilities made available. In peacetime the connection of a new factory or an increase in demand at an existing factory can, subject to certain assurances, be regarded as a permanent producer of increased revenue. It thus takes its place in the general layout of the distribution system with particular regard to protection, operation (from the works and the undertaking's point of view), reliability of supply with regard to premeditated or unpremeditated interruptions, and so on, and the extra capital spent on that account will be amply repaid in operational savings over the life of the gear involved.

But when the connection arises from a demand for a short period which can scarcely approach the life of the gear, one good reason for reduced facilities emerges and this is considerably strengthened when the need for absolute economy in materials and labour (particularly skilled labour) is of vast importance, and little justification for the usual standards can therefore be found. Thus economy of labour and materials must be exercised to the utmost degree compatible with safety and efficiency and in this engineers may find difficulty in readjusting ideas formed over a long period of routine experience. In some cases it may be found that a quality of gear (so long as it is sound) can be used which is cheaper as it lacks many refinements. It should be borne in mind that gear designed to give first-class service for thirty years or more is not necessarily needed when perhaps four or five years' service is all that is required.

Again, switching schemes, busbar arrangements and cabling can often be simplified with very considerable economy and only minor possibilities of inconvenience. Government Departments have recently given a lead in this direction, and have relaxed substantially the standards which they previously specified for work, irrespective of whether it was for permanent or temporary requirements. This change in outlook is evidenced by the confidence which a Government Department is known to have placed in the general reliability of supply from one power company and in its ability to effect rapid reconstruction should the need arise, by arranging for a large new works to have only a single high-voltage supply where, under previous routine, two such supplies and possibly a local standby unit would have been *de rigueur*.

While the supplying of new works with the utmost speed calls for compromise, teamwork and drive by the staffs concerned, it is in increasing supplies to existing works that possibly the greatest resourcefulness and ingenuity is needed. Instances of the necessity for speed and the way in which this has been met cannot, in many cases, be quoted until after the war has been won, but it may now be disclosed that near the beginning of the war, a Government Department rang up an electricity supply company at 11 o'clock on a Saturday morning and demanded a substantial DC supply at an unusually low voltage, for an extremely urgent but temporary repair job. At first it seemed impossible to meet this demand, but after an urgent conference among the staff concerned, followed by a further conference with a Government official and others interested in the repair, it appeared that there was a possibility that the supply could be afforded.

The nearest supply of any type was some considerable distance away and that was 440-V AC, but it was found that a mercury arc rectifier which could be spared, at least for the time being, from a consumer's works some 75 miles away in another part of the company's area might be suitable after some modifications had been made. Further conferences followed and a scheme was evolved, the effect of which was to have the requisite supply available in 54 hours, during which time a building had to be erected, the gear modified, assembled and installed, cables run and the whole job connected up. As a result many days were saved in the time required for the repair, as the only alternative would have been to endeavour to install a prime mover and generator, and there was no knowledge of where this might be obtainable or, if it were obtainable, how long it would take for assembly, transport, erection, etc.

Transformer Loading

Substation apparatus often becomes overloaded suddenly and immediate steps have to be taken to prevent an emergency condition becoming acute. In this connection it cannot be too strongly stressed that a well-built transformer is a robust piece of apparatus and full advantage can be taken of this when considering the loading of such units, a matter well brought out and expanded in an article on the subject in a recent issue of this journal.*

There are no doubt many engineers who keep B.S.S.171–1936 open on their desks at Appendix B and with discretion are saving themselves much worry and their undertaking or their consumers

* "Transformer Overloads," by C. Anderson, *Electrical Review*, Sept. 27th.

a lot of money, but there often seems to be some confused thinking as to the capacity of transformers and it should be realised that this is governed only by the temperature attained and by the voltage regulation which results. Thus, in general and on the assumption that there are no hot spots, the temperature of a unit is a better guide to conditions than kVA loading, and improved ventilation will often go a long way towards helping a transformer, as it will to a lesser extent other pieces of apparatus, to carry over a critical time.

Many substation buildings, particularly those of an older type, are capable of considerably better ventilation and there may be cases where a thermostatically controlled fan will make a marked difference to the temperature at very small cost. At least one large undertaking has scheduled all its industrial-type transformers with their loadings, and it is often possible, by interchanging two or more units, to save purchasing new. Thus some works, notably those manufacturing articles for domestic consumption, *e.g.*, furniture, carpets, confectionery, are now much slacker than in peacetime, and the same can be said for some road stone quarries, etc. By a small amount of organisation much new expenditure has been avoided by judicious interchange, although most probably the reverse process will be necessary when victory comes.

Power-factor Correction

The power factor of the supply taken should be carefully watched, particularly where a power-factor tariff is not in operation. While condensers give the same effect, up to a limit, of increased transformer capacity they are, except when the power factor is exceptionally low, more costly than a larger transformer unless credit can be taken for the displaced unit, but their merits are far more extensive. It would, in many instances, pay the consumer and ultimately the undertaking to study either the alternatives of power-factor improvement or increased capacity of service cables and apparatus, as in many cases a condenser is the better proposition even if, in return for bearing the cost of improvement, the consumer yields somewhat less revenue to the undertaking.

There are occasions when a large increase in supply is required by an existing works and here the problem is whether to increase the present service apparatus or to put down a second substation. In such cases the value of A.R.P. is worth while taking into account as a second and, to some extent, an alternative substation may have distinct advantages. It will also be borne in mind that the new gear (which should be connected to a separate part of the high-voltage system) for a second substation will be of smaller capacity than replacement gear for the original substation would have to be, and the possibility of using stock apparatus is thus strengthened.

A feature which must not be overlooked is the financial side of the arrangements made for new or increased supplies. It is usual in normal times for the undertaking to bear the whole or a substantial part of the expenditure involved and it has, in part, been due to this that factory owners have been so ready to rely on purchased power for their requirements. This expenditure on the part of the undertaking was recouped over a long period in the tariff arranged, but this is highly unlikely to be so in the case of supplies which are only needed for the duration of the war and thus the undertaking would ultimately, under normal arrangements, be left with what might well be a vast amount of unprofitable capital expenditure. This has been recognised by Government Departments and a lead has been given to Government contractors in agreeing to bear the whole of the capital expenditure incurred on connection ; but to this extent the tariff arranged should eliminate interest charges appropriate to such expenditure that it would otherwise contain, while depreciation and maintenance charges require consideration in the light of the particular case.

At the same time there is, therefore, not the same need, as in peacetime, for long-term agreements incorporating substantial fixed charges or other forms of guarantee. While the adjustment accordingly of any standard tariffs might, at first sight, appear to give preference to such supplies, this is not so in fact as such tariffs are essentially framed on the assumption that the undertaking will bear substantially the greater part of all capital expenditure involved.

It seems that the function in wartime of electrical undertakings, apart from ensuring that they can deal with the demands upon them, is that performed by the realistic knowledge that they hold an important key to victory. By their ingenuity and resource and, by their refusal to be shackled by the usual routine methods and traditions, that key can be of the utmost value in opening many of the doors through which passage must be gained in this conflict of machinery, materials and equipment.

The 1940 Heat Drop Tables

Interpolation Facilitated

THE British Electrical and Allied Manufacturers' Association has once again provided a most useful publication giving the values of the available adiabatic heat drop for steam with a large range of working conditions. This volume is a natural sequel to the 1939 Callendar Steam Tables which were reviewed in our issue of June 9th, 1939.

As this is the fourth volume of this nature it may be useful to say that the first issue was in 1917 and covered up to 400 lb. per sq. in. g., a superheat of 300 deg. and vacua up to 29.1 in. As that pressure proved too low for practice, a supplementary volume was produced in 1925, continuing the pressure up to 2,000 lb. with no change in superheat but with vacua to 29.5 in.

These supplementary figures were based upon extrapolations from low-pressure observations and therefore there was some measure of uncertainty in their accuracy. Following the 1929 (London) and 1930 (Berlin) meetings of the International Steam Tables Conference, new steam tables (The Revised Callendar Steam Tables, 1931) were issued and corresponding Heat Drop Tables followed automatically in 1931. These have now been replaced by the volume under review, which is really based upon the 1934 (New York) meeting of the above conference and subsequent work.

The tables are the same size as before and occupy 88 pages as against 79 in 1931. The first twelve pages contain useful explanatory matter, and conversion tables for pressures and temperatures. In this portion more detailed and very useful information is given than appeared earlier regarding correct means of interpolation, based on Bessel's formula. Indication is also given of the mechanical means by which the calculations had been made.

As regards the tables themselves, the pressures remain as in 1931, whilst the temperature range is also the same. Heat drops are given for temperature intervals of 20 deg. whereas the interval in 1931 was 25 deg. This will facilitate interpolation, making it almost entirely mental. Additional pages have been introduced for the higher vacua which now have intervals of only 0.05 from 28.70 in. to 29.50 in.

All figures are given in blocks of five pressure lines, whereas in 1931 the divisions were not quite uniform; and the thumb indexing is an improvement upon the earlier issues.

To see briefly what change there has been in ascertained values of the heat drop in 23 years the following have been calculated :—

400 *lb.*, 700 *deg.*, 29.0″ :

1917	485.4 B.Th.U.	
1931	484.05 „	Range 0.75 B.Th.U.
1940	473.3 „	or 0.15%

Range 2.1 B.Th.U. or 0.43%.

600 *lb.*, 800 *deg.*, 29.0″ :

1925	536.8 B.Th.U.	
1931	531.14 „	Range 0.24 B.Th U.
1940	530.0 „	or .045%

Range 5.9 B.Th.U. or 1.11%.

1,200 *lb.*, 930 *deg.*, 29.0″ :

1925	Not covered
1931	599.40 B.Th.U.
1940	598.5 „

Range 0.9 B.Th.U. or 0.15%.

The closer agreement between the 1931 and 1940 values indicates an approach to the real values and the error is now such as would not cause any uncertainty to any turbine designer. It should be noticed that whilst the 1931 tables gave values to the second decimal place, the later ones recognise the probable limits of accuracy by limiting them to one decimal place.

The volume has been published by Messrs. Edward Arnold & Co. for the B.E.A.M.A., whereas the earlier tables were issued by the same firm for the E.R.A.

COMMERCIAL and INDUSTRIAL NEWS

Plant Costing Scheme. Machine Tool Licensing. Factory Lighting

Costing of I.C. Engines

FOR a considerable time past a committee of the Internal Combustion Engine Manufacturers' Association, with the assistance of Deloitte, Plender, Griffiths & Co. and of a sub-committee consisting of cost accountants of members of the Association, and with the special assistance of Mr. G. Pawlyn and Mr. Graham Watson, have been engaged on negotiations with the heads of costing branches of the Admiralty, Ministry of Supply and Air Ministry, acting on behalf of the Contracts Co-ordinating Committee, for agreement on a scheme of cost ascertainment which would be accepted and applied by those three Government Departments in the case of all contracts for the manufacture and supply to those Departments by members of the Association of internal combustion engines coming within the scope of the Association where the contract provided that the contract price should be a fair and reasonable price to be agreed having regard to costs. As a result a cost ascertainment scheme has now been finally agreed which it is stated will relieve the members of the Association of many difficulties for which, for some time past, they have sought a remedy.

The scheme has been framed to be generally applicable to the manufacture of all engineering products and not merely internal combustion engines. The Admiralty, the Ministry of Supply and the Air Ministry are prepared to consider the application of the scheme generally and not limit it to internal combustion engines. It will be appreciated that it is in the power of those Departments on their own motion if they think fit to apply the scheme to any engineering contract where the contract price is provided to be determined with reference to costs, without prior agreement.

The Purchase Tax

Inquiries have been received whether it is possible for registered firms to avoid liability to tax on certain classes of goods by selling them separately in parts. A purchase is defined by Section 41 of the Finance (No. 2) Act, 1940, as including, not merely contracts of sale, but " any transaction in whatsoever form expressed in so far as its effect is in substance the same as the effect of a contract of sale." Accordingly, when a chargeable article is sold in parts, either together or separately, liability to tax is incurred in the same way as if the complete article were being sold and firms concerned will be held accountable for tax on their sales in such cases in accordance with the provisions of the law. In the same way, when an article is supplied and payment is accepted partly in kind the transaction is a sale for Purchase Tax purposes and (unless the sale is made to another registered person buying the goods as stock or material) tax is payable on the full wholesale value of the article. This applies whether the article supplied is new or reconditioned, and irrespective of the form which the contract or transaction takes if its effect is as described above.

Control of Instrument Exports

The Export of Goods (Control) (No. 41) Order, 1940, *inter alia*, amends the first schedule of the Export of Goods (Control) (No. 39) Order in so far as it respects electrical instruments. It replaces the item " Electrical measuring instruments, the following :—Voltmeters and ammeters of a diameter (including the bezel) of 2 inches or more but not exceeding 2½ inches " by " Electrical instruments, the following :—Voltmeters and ammeters of the circular type, of a diameter (including the bezel) of 2 inches or more, but not exceeding 7 inches." The export of these to any destination is prohibited save under licence from the Board of Trade.

The Birmingham Electric Club

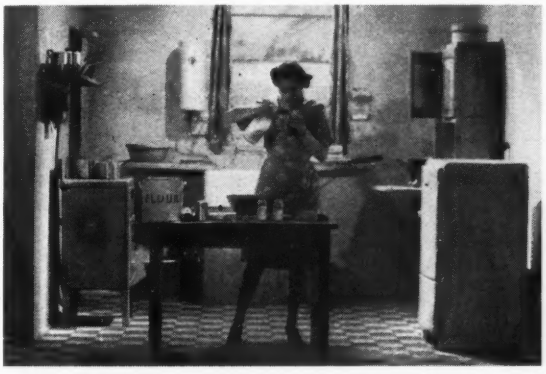
The annual general meeting of the Birmingham Electric Club is being held to-day (Friday) at the Grand Hotel, Birmingham, at 12.15 p.m. and will be followed by the Christmas luncheon at 1.15 p.m.

Scottish Electricians' Wages

In accordance with the terms of an agreement entered into between the Electrical Contractors' Association of Scotland and the Electrical Trades Union to regulate the wages of electricians on a cost-of-living sliding scale agreement, an increase of ¼d. per hour took place on and from Dec. 1st. The new rate is 1s. 9¾d. per hour. The next review will take place in Feb., 1941, and thereafter a further adjustment will be made in March. The increase in journeymen's wages, besides affecting the electrical contracting industry, also applies to electricians employed on the maintenance of electrical equipment in all classes of factories and workshops, and to a large number of men employed by local authorities.

The E.D.A. Films

In our issue of November 29th we drew attention to the new E.D.A. films which were produced to assist the Ministry of Food in conjunction with the Board of Education, and local educational authorities to encourage the economical use of food in wartime.



A " still " from the E.D.A. film " Do You Take Enough Milk? "

Unfortunately, since the film " Do You Take Enough Milk ? " was produced circumstances have altered the situation and much of the propaganda has now lost its point. Nevertheless, there is much in the film of electrical interest and, as the accompanying reproduction of a " still " from the film shows, the model kitchen, with its electric refrigerator, cooker and water heater should serve to encourage the use of electricity in this important domestic sphere.

Canadian Tariff Modifications

The Canadian Finance Minister announced recently that the import duties on a number of British commodities, including electric motors, were to be reduced. He also said that to prevent Canadian manufacturers from endeavouring to meet the demand for " luxury " goods created by import restrictions a 25 per cent. excise tax was to be imposed on radio sets, electrical appliances of many kinds and other products.

Women in the Cable-making Industry

As a wartime measure the Joint Industrial Council of the Electric Cable Making Industry has agreed to the admission of women into employment hitherto performed by men. Skilled females already engaged in the industry will receive preference and special consideration will be given to those whose standard of living may have been affected by the departure of relatives for service in the forces.

Board of Trade Prosecution

The Board of Trade calls the attention of manufacturers of machinery and plant, and those buying machinery, plant, or parts from manufacturers to the fact that the supply of numerous classes of machinery, plant and parts may take place only if the necessary licence is obtained from the Board of Trade. Any person desiring to acquire such machinery, plant or parts must therefore first obtain a supply licence, and manufacturers should make sure that the person proposing to acquire the machinery or plant has a licence.

On October 30th, a company was convicted of an offence against paragraph 1 of the Machinery & Plant (Control) Order, 1940, for supplying machinery to a person not authorised to acquire such machinery by virtue of a licence granted by the Board of Trade, and was fined £20 and ordered to pay 30 guineas costs. The relevant Board of Trade requirements are set out in Statutory Rules and Orders, 1940, Nos. 875 and 1363 which are obtainable from the Stationery Office. The latter Order gives the list of machinery for which licences are necessary. The operation of the Order is further explained in the *Board of Trade Journal* of August 1st, which also contains the list of machinery and plant affected. The Orders apply also to secondhandand imported machinery and plant. Application for licences should be made to the Industrial Supplies Department (Machinery Licences Division), Board of Trade, 25, Southampton Buildings, Chancery Lane, London, W.C.2.

Factory Lighting Conferences

The recently formed National Industrial Electric Lighting Service, with headquarters at the E.L.M.A. Lighting Service Bureau, has quickly taken its place as an effective force in the cause of efficient lighting under wartime conditions in factories and workshops and, with a view to bringing together various sections of the electrical industry for short talks on the subject, several conferences are being held at a number of provincial centres.

The general idea of holding these conferences throughout the country is to explain the objects of the Service, to discuss the Draft Regulations for Factory Lighting, and to give practical suggestions on the re-lighting of factories in wartime.

Already these gatherings have taken place in London, Glasgow and Leeds, and have been well attended. The most recent of the series were held at Cardiff and Birmingham, on December 4th and 5th respectively. At Cardiff, in the lecture theatre of the South Wales Institute of Engineers, Alderman A. E. Gough, J.P., chairman of the Cardiff Electricity Department, presided, and emphasised the vital importance of good illumination in industry today, particularly mentioning its effect on the welfare of the workers. In the absence of Sir Duncan Wilson, chairman of the Joint Lighting Committee, Mr. W. J. Jones dealt with the new Draft Regulations and outlined the special wartime lighting requirements of factories, including those controlled by the Ministry of Supply, the Admiralty, and the Ministry of Aircraft Production. He explained the National Industrial Electric Lighting Service and its comprehensive operational scheme, pointing out the several ways in which its advice and assistance might be of use. Messrs. A. E. Iliffe, L. H. Hubble, and R. O. Ackerley then gave short talks on practical aspects of wartime industrial lighting. Mr. Iliffe stressed the importance of "pulling together" and lessening competition as far as possible at the present time; Mr. Hubble further explained the proposed factory lighting installations; and Mr. Ackerley made the good point that all this assistance was "not intended to stop you thinking, but to help you to think."

"Osira" fluorescent lamps in a drawing office

At the Birmingham Conference, held at the Chamber of Commerce, Mr. F. Forrest, chief engineer and manager, Birmingham Electric Supply Department, who had hoped to preside, was unable to be present; the chair was therefore taken by Mr. R. H. Rawll, sales and development engineer, who spoke briefly upon the general aims of the conference. Mr. A. E. Iliffe took the place of Sir Duncan Wilson in explaining the Draft Regulations, and then went on to deal with lighting service for industry in wartime.

Mr. R. O Ackerley and Mr. C. R. Bicknell followed with brief practical talks and expert suggestions. About a hundred representatives of the electrical and allied industries were present.

A similar conference was held at Edinburgh last week at which factors, manufacturers, and supply interests from the east coast of Scotland, from Galashiels to Aberdeen, were represented, in addition to the E.C.A. of Scotland and other bodies connected with the electrical industry.

Further conferences will be held from time to time at different centres.

The Red Cross in Egypt

The outbreak of large scale hostilities in Egypt finds the Red Cross in that area well equipped and ready for anything. At the beginning of November over £120,000 had been spent by the Red Cross Middle East Commission, which is responsible for the organisation in Egypt, and now that the desert war has started in earnest expenditure is bound to leap upwards. Four million regular contributors to the Red Cross Penny-a-Week Fund are already providing financial ammunition at the rate of £15,000 a week for this and the many other Red Cross activities, and the secretary of the fund appeals to those who are not contributing, to become "penny-a-weekers." They should apply to him at 89, Kingsway, London, W.C.2.

The "Electrical Review" Index

The index for Volume CXXVII of the ELECTRICAL REVIEW, covering the period from July 5th to November 1st, 1940, is now available free on application to the publishers. Cases for binding are obtainable at 3s. 6d. each (3s. 10d., post free) and owing to the difference in size readers should specify the number of the volume in question.

Drawing Office Illumination

The problem of illuminating drawing offices in which the work entails the reading of blue prints, making detailed drawings and generally carrying out close work that imposes a strain on the eyes, has always invited the application of the most up-to-date lighting principles. When the General Electric Co., Ltd. was called in to specify a lighting scheme for the drawing office of a large Midland engineering company, it recommended the installation of "Osira" 5 ft. mains operated fluorescent tubular lamps.

The entire lack of glare, the near-daylight colour and coolness in operation of this lamp are characteristics which make it particularly suited for the purpose and the resultant even illumination is of high intensity, with complete absence of hard shadows. This installation has been arranged so that the reflectors are at right angles to the drawing boards, the rows of reflectors being spaced 7 ft. apart, as can be seen in the accompanying illustration. The illumination provided is of the order of 30 ft.-candles at board level. It will be noticed that the skylights have been blacked out and that there are blinds for the side windows for use at night, the daylight being admitted during the day for purely psychological reasons.

E.A.W. Certificate Examinations

The National Training and Diploma Committee of the E.A.W. has decided that the certificate examinations shall be held once yearly during the war in view of the black-out and travelling problems. In future, therefore, examinations will be held only in June each year. The date of the June, 1941, examination will be announced early in the year. The Committee has decided that diploma tests shall continue to be held as usual.

Calendars

Robey & Co., Ltd., have sent us a neat calendar with monthly sheets.

We have again received from Lindsay & Williams a calendar with large daily slips with bold red figures mounted on a strong board.

Trade Announcements

The new head office and warehouse of the Donovan Electrical Co., Ltd. is Flaxley Hall, Flaxley Road, Stechford, Birmingham, 9.

The Armos Radio & Electrical Co., Ltd., has removed its offices and stores to 60, Larkshall Road, Highams Park, London, E.4.

The London office of the Simplex Electric Co., Ltd., has been removed to 66, Victoria Street, S.W.1 (telephone: Victoria 5359 and 7241). Orders and letters regarding deliveries should be addressed to the company's stores at 8, Alfred Place, London, W.C. (telephone: Museum 9361). The London showrooms are temporarily closed, but deliveries and service facilities, including the trade counter, are being continued as usual.

The temporary address of Charles White (London), Ltd., wholesale electricity suppliers, is c/o W. N. Jones & Son, Ltd., 11-12, Bread Street Hill, Upper Thames Street, London, E.C.4 (telephone: Central 4473).

The new address of the Bristol office of Callender's Cable & Construction Co., Ltd., is 51, Queen Charlotte Street, Bristol.

The address of the Birmingham branch of Falk, Stadelmann & Co., Ltd., is now 66 to 68, George Street Parade, Birmingham (telephone: Central 8031).

The telephone number of Salford Electrical Instruments, Ltd., has been changed to Blackfriars 6688.

The Southampton branch of the Simplex Electric Co., Ltd., is now at Lower Canal Walk, Southampton (telephone: Southampton 6391).

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

Surface type insulated switches with luminous dollies. (Immediate supply.)

TRADE MARK APPLICATION

AMONG recent applications for British trade marks is the following, objections against which may be entered within one month of December 11th:—

Hamofil (design). No. 612,814, Class 9 (IV). Insulated electric cables and wire. Hammans Industries, Ltd., Abford House, Wilton Road, London, S.W.1.

ELECTRICITY SUPPLY

Leyton Staff Commended. Further Mutual Aid Schemes

Aldershot.—MUTUAL AID.—It was reported at a recent meeting of the Borough Council that arrangements had been made with the Reading, Basingstoke and Farnham undertakings for mutual assistance in emergency.

Ballater.—PROPOSED SALE OF UNDERTAKING.—Duncan's Electricity Supply Co., Ltd., has notified Ballater consumers of its intention to terminate existing agreements on January 1st. In making the announcement the company states that if the Town Council's consent is obtained it proposes to dispose of its undertaking to the Grampian Electric Supply Co.

Barrow-in-Furness.—KETTLES FOR WARDENS' POSTS.—The Corporation Emergency Committee is to provide electric kettles at wardens' posts.

LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to borrow £5,500 for the reconstruction and erection of substations, £5,176 for supply to the Barrow Paper Works and the Barrow Hæmatite Steel Co., Ltd., and £2,000 for electrical apparatus.

EXTENSIONS.—Supplies of electricity are to be provided to Torver at a cost of £213, to Roosecote (£130) and to Nibthwaite (£375).

Blackpool.—TRANSMISSION LINE ALTERATIONS.—The Corporation Electricity Committee has approved an estimate of £14,605 for the extension and modification of the Fylde Coast 33-kV transmission system.

Brighouse.—ELECTRIC PUMPS.—Two electric pumps are to be installed at the refuse disposal works.

Burton-on-Trent.—LOAN.—The electricity Committee is seeking sanction to borrow £5,509 for mains, &c.

Canterbury.—HIGHER CHARGES.—The City Council has approved a further increase of 7½ per cent., making 12½ per cent. in all since the beginning of the war, in the electricity tariffs. The increase is to take effect at the end of the present quarter and will apply to all the tariffs with the exception of the maximum demand tariff, which is to remain at 8d. per kWh, though consumption in excess of the amount stipulated in the contract is in future to be charged at 1½d. per kWh instead of 1d. The chairman of the Electricity Committee (Alderman C. Lefevre) explained at the last Council meeting that, while output had fallen, production costs had greatly increased.

SHELTER HEATING.—The Council has instructed the Surveyor to put in hand improvements to school shelters, including an electric heater in each, at a total estimated cost of £481.

Cardiff.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £327.

Carlisle. — SUPPLY TO BRICKWORKS. — Sanction has been received to a loan of £732 for supplying Sandyside Brickworks.

Cheadle and Gatley.—SHOWROOMS TO BE USED AGAIN.—The Urban District Council's electricity showroom at Cheadle Hulme, which has been out of use for some time, is to be brought into commission again. It will be used partly for lectures and demonstrations in connection with war-time cookery and partly by other departments of the Council.

Chesham.—FRINGE ORDER.—The Chesham Electric Light & Power Co. is seeking a Fringe Order to supply premises in Penmans Green.

Chesterfield.—FRINGE ORDER.—An application by the Derbyshire and Nottinghamshire Electric Power Co. for a Fringe Order to supply premises at Engine Hollow, Barlow, has been agreed to by the Corporation Electricity Committee.

Clitheroe.—ELECTRICITY FOR SLAIDBURN ? —The Corporation Electricity Committee is considering affording a supply of electricity to Slaidburn.

Derby.—BETTER RESULTS.—During the twelve months ending March 31st last, the Electricity Department made a profit of £35,674, against a loss of £5,792 on the previous year's working. This was largely due to the withdrawal of the cash discount on consumers' accounts, and to a revision of the domestic two-part tariff.

Gateshead.—SHELTER LIGHTING.—Permission to spend £181 on the installation of electric lighting in certain communal shelters has been received by the Town Council.

Glasgow.—HARBOUR EQUIPMENT.—It is reported by the *Engineer* that new equipment for Glasgow harbour, costing more than £100,000, has been sanctioned by the Clyde Navigation Trust. Among the items specified are six 8-ton electric level luffing cranes, four 3-ton electric travelling portal level luffing cranes, and the conversion to level luffing type of two 8-ton and eleven 4-ton existing fixed jib cranes. New electrical switchgear, distribution cables and other equipment will cost nearly £3,500, and mercury vapour rectifier plant is to be installed.

Leyton.—COMMENDATION OF STAFF.—At a recent meeting of the Borough Council it was reported that the Electricity Commissioners had written thanking and congratulating the staff of the Electricity Department for their excellent work in recent emergencies.

Lichfield.—LIGHTNING ARRESTORS.—Additional lightning arrestors on overhead lines are to be provided by the Corporation Electricity Committee at a cost of £590.

PILOT CABLE EXTENSIONS.—The Committee is also to extend the pilot cable from Airewas to Orgreave as and when possible.

London. — WESTMINSTER. — A sum of £2,000 is to be spent by the City Council on electric lighting and bunks for vaults now being used as air-raid shelters.

WOOLWICH.—The 20 per cent. rebate allowed on accounts of electricity consumers under the fixed charge portion of the tariff of charges, Scale C, has been withdrawn as from the first quarterly charge date after October 1st last.

EMERGENCY PUMPING PLANT. — The Metropolitan Water Board is to purchase emergency pumping plant, etc., costing £32,450, which will include three 150-kW Diesel generating sets, two large capacity electrically driven pumps and an electrically driven borehole pump.

Loughborough. — SHELTER LIGHTING.— The borough electrical engineer and borough surveyor are to confer with the architects, A. E. King & Co., on the question of lighting air-raid shelters.

Morecambe and Heysham.—SUPPLY TO SANATORIUM.—The Electricity Committee proposes to lay a cable to the former sanatorium at Bare, for Thomas Price, Ltd.

Morley.—MAINS AND SERVICES.—The Corporation Electricity Committee is to apply for sanction to a loan of £2,500 for unspecified mains and services.

Nelson. — TEMPORARY SUPPLY. — The chairman of the Electricity Committee reported to the Town Council on December 3rd on an interview with Mr. A. N. East, engineering inspector to the Electricity Commissioners, concerning a temporary supply to Barnoldswick, proposed to be obtained from Yorkshire Electric Power Co., and also the action the Corporation should take regarding future demands by Barnoldswick District Council. The electrical engineer submitted three schemes for dealing with the prospective requirements of Barnoldswick, and it was decided to submit these to the Electricity Commissioners for their consideration.

LOAN FOR APPLIANCES.—The Corporation is applying to the Electricity Commissioners for sanction to borrow £9,000 for electric cookers and other appliances.

Sheffield.—MAINS EXTENSIONS.—Expenditure on mains amounting to £5,230 has been approved by the City Electricity Committee.

Skipton.—CHARGES FOR SHELTER SUPPLIES.—The Urban Council has arranged with the West Riding County Council for the supply of electricity for public air-raid shelters on the following terms:—Fixed quarterly charge, £1 10s. per kW per quarter (minimum charge 7s. 6d.); 1½d. per kWh for the first 160 kWh per quarter, with 1d. for each additional kWh; and meter rent charge.

South Shields.—EXTENSION APPROVED.—No objection is being offered by the Town Council to the erection of an overhead and underground line on the Horsely Hill Estate by the North-Eastern Electric Supply Co., Ltd.

CHARGES TO HOSPITALS.—The Town Council is to ask the North-Eastern Electric Supply Co. Ltd., for a reduction in electricity charges for the hospitals.

RENTAL FOR TYNE DOCK CABLE.—A report submitted to the Town Council states that three years ago the Council arranged to use the Tyne Improvement Commission's cables for supplying electricity to the Commission's tenants at Tyne Dock. It was arranged that the Corporation paid to the Commission a percentage of the revenue as rental but this allowance, states the report, has not yet been paid. The Council has decided to pay £500 to the Commission for the past three years and to ask the Commission to accept £110 per annum for subsequent years as long as the present agreement is in force.

Stalybridge.—MUTUAL AID SCHEME.—The engineer to the Stalybridge, Hyde, Mossley and Dukinfield Joint Board (Mr. J. H. Lumsden), reported recently that he had provisionally arranged with adjacent electricity undertakings to participate in a scheme of mutual assistance by which men, materials and equipment would be transferred from one undertaking to another should the necessity arise.

RIPPLE CONTROL.—At the suggestion of the engineer the chairman of the Joint Board asked the Board to consider the installation of the ripple remote control system for transmitting signals to the A.R.P. personnel of the four boroughs at a cost of about £10,000. The matter was referred to the War Emergency Committee.

Stockport.—DISCOUNT ABOLISHED.—The discount allowed for prompt payment of accounts is to be abolished. Explaining the reason for this step at a Town Council

meeting, Councillor Randles said that these discounts were "rather a pest." There were many separate items on the electricity accounts, but the discount was only payable on the current consumed, and each item had to be worked out. It was often only a matter of pence. The big users were on a special rate, and the people who would miss the discount were the middle-class household users, shopkeepers, and some manufacturers, but this was war-time and many things had to be put up with.

Stroud.—OVERHEAD LINES.—The Rural District Council has approved the erection by the West Gloucestershire Power Co. of a number of overhead lines.

Stretford.—SHELTER HEATING.—The Stretford and District Electricity Board has commenced the installation of safe electric heaters in air-raid shelters at the cost of 26s. down and five quarterly payments of £1.

Tonbridge.—1939-40 RESULTS.—The gross profit for the year ended March 31st last was £12,484 and the net profit £1,897. The addition of £9,350 brought forward made a sum of £11,247 available. From this £1,718 was allocated to capital expenditure out of revenue and £600 to the relief of rates, leaving a balance in hand of £8,929. An increase of 542,627 kWh in sales (to 8,370,537 kWh) was due to a rise in domestic consumption; there were decreases in most other directions.

Ulverston.—PURCHASE OF DOMESTIC APPLIANCES.—The Urban District Council is applying to the Electricity Commissioners for sanction to borrow £700 for the purchase of domestic appliances.

Walsall.—EXTENSIONS.—The Corporation Electricity Committee is to provide a supply to A. S. Smith & Sons, Ltd., at a cost of £1,060, and also an additional supply to the Bloxwich Lock & Stamping Co., Ltd. at a cost of £870.

Workington.—SUPPLY TO HOUSES.—The Corporation Housing Committee has approved an estimate of the Electricity Department for supplying electricity to ninety-six houses at Salterbeck, at a cost of £3,354.

Worthing.—DEARER ELECTRICITY.—The Corporation Electricity Committee recommends that the lighting flat rate should be increased to 33⅓ per cent. above the pre-war tariff (4½d. per kWh), with corresponding increases in other tariffs.

Yorkshire.—MUTUAL CO-OPERATION.—The electricity undertakings of Dewsbury, Mirfield, Batley, Heckmondwike, Spenborough, Morley, Leeds, Pudsey, Wakefield, Normanton, and Pontefract are exchanging information with a view to mutual co-operation in the event of damage caused by enemy action.

TRANSPORT

Cardiff.—ALTERATIONS TO DEPOT.—The Corporation is to adapt the Clare Road depot for trolley bus purposes at a cost of £4,305.

Newcastle-on-Tyne.—NO INCREASE IN FARES.—An application by the City Council to replace the present penny fare on trams by a three-halfpenny fare has been rejected for the time being by the Ministry of Transport. The City Council applied for the increase on the grounds of heavy burdens on the undertaking due to A.R.P. work and allowances to employees in the Forces. The Ministry of Transport suggests that the Council should wait until the end of the financial year, when the exact effect of the extra charges on the undertaking can be ascertained.

Russia.—NEW TROLLEY BUSES.—*Reuter's Trade Service* learns from Moscow that the Yaroslav motor works recently completed its first batch of a new type of trolley buses. They are considerably sturdier and smarter than those previously produced by the works, while the bodies are not wooden, but half metal. The weight of the vehicle has been reduced by a ton, but the number of passenger seats increased to 55.

RADIO AND TELEPHONY

Burnley.—REMOVAL OF RELAY WIRES.—The Town Council has given notice to Amalgamated Relays, Ltd., to remove temporary overhead wires across certain highways, and in the event of default will remove the wires at the expense of the company. The company provides a broadcast service to between 7,000 and 8,000 subscribers. There is a dispute between the company and the Corporation as to the practicability, or otherwise, of placing lines underground at certain crossings.

Russia.—NEW BROADCASTING STATIONS.—According to the Soviet Radio the Moscow-Leningrad broadcasting system is to be considerably extended and several new stations are to be erected.

Salford.—POLICE AND FIRE BRIGADE WIRELESS.—The Watch Committee has decided to install a high-frequency wireless installation for the use of the city police force and the fire brigade. This will enable two-way communications to be maintained in all emergencies between the control centre and police headquarters, the divisional police offices, police cars, the fire station and the main fire engines. The main installation will comprise a 100-W transmitter and 7-W transmitters in the other places and vehicles.

Southport.—POLICE RADIO.—The Watch Committee has approved a system of wireless communication for the use of the borough police force. It will cost £1,175, with an addition of £106 for remote control.

South Shields.—RADIO FOR POLICE AND FIRE BRIGADES.—A sum of £1,250 is to be spent on the installation of wireless telegraphy for the police and fire brigades.

Sunderland.—WIRELESS SCHEME REJECTED.—The Finance Committee has rejected a plan by the Watch Committee to spend £1,675 on the installation of wireless telegraphy for the police force and £369 for similar apparatus for the fire brigade.

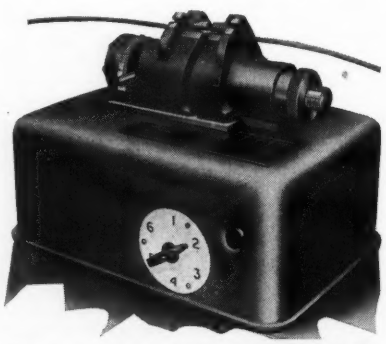
Modified Slow Butt-Welder

Arrangements for Annealing Joints

EQUIPMENT for resistance (or slow) butt-welding, which is based on the generation of heat locally by the passage of a heavy current through two pieces of metal with square cut ends in contact, must include provision for applying the electrical energy as well as the necessary pressure to keep the whole surface of the parts together during the heating period, squeezing out oxide, and to give the necessary "push up."

Slow butt-welding is generally limited to non-ferrous metals (of all sections) and to steel sections under ¼ in. square. Quality of weld is governed by current, upset pressure and point of current cut-off, which are adjusted to give the best performance. Since heating a carbon steel above the upper critical temperature and then cooling it rapidly causes local hardening, the machine should make provision for annealing the joint.

The self-contained resistance butt-welder illustrated (rated at 2.5 kVA and standing 3 ft. 6 in. high) was made by the Metropolitan-Vickers Electrical Co., Ltd., primarily for dealing with wires of various sizes, but with the welding jaws slightly modified it can be adapted for other shapes having approximately the same cross-section range. The standard equipment will weld mild-steel and high-carbon-steel wire of from 20 to 4 SWG and copper and bronze wire and aluminium wire of from 20 to 8 SWG.



Close-up view of top of Metrovick butt-welding machine

The jaws comprise a fixed and a movable member mounted on top of the machine. The movable member opens against spring pressure and is operated individually by a foot pedal. Vee grooves in the jaws for different gauges enable the pieces to be aligned in view of the operator. The amount of "push up" is adjusted by moving a lever on the left of the machine. This controls the movement of an internal cam which sets the position of the right-hand jaws carried by a sliding platen. A graduated scale enables any established set of welding conditions to be repeated exactly. A knurled thumb-nut permits pressures from 5 to 25 lb. to be obtained. A rotary current-selector switch gives five different settings. The point of current cut-off is adjustable and, once set, it is automatically in operation.

A push-button is depressed when the work has been clamped in the machine jaws and the settings of current and pressure have been made. If it is held in that position, the weld will be automatically completed, but if released welding will cease at that point. After welding, the work can be withdrawn to a pair of annealing jaws which form an extension of the welding jaws.

A table of settings for different materials is fixed on the top sheet-steel casing of the machine. The supply trailing cable is taken in at the rear through a Wylex gland.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Building, London, W.C.2.

1939

4478. "Carbon sliding contact members for the collectors of electric vehicles." E. Conradty and O. Conradty (trading as C. Conradty). February 10th, 1939. (529302.)

5603. "Combinations of electric discharge lamps with means for operating them." General Electric Co., Ltd., J. N. Bowtell and H. G. Jenkins. February 20th, 1939. (529576.)

8447. "Electric regulating systems." British Thomson-Houston Co., Ltd. March 17th, 1938. (529577.)

9841. "Electrical musical instruments." L. Hammond. April 2nd, 1938. (529304.)

11522. "Electrically-operated soot-blowers." Hopkinsons, Ltd., R. L. Brown and W. B. Dale. April 15th, 1939. (529306.)

11581. "Thermionic amplifiers." B. M. Hadfield. April 17th, 1939. (529441.)

11917. "Electric lamps, discharge devices, and the like." General Electric Co., Ltd., and G. Chelioti. April 20th, 1939. (529374.)

12079. "Electric indicating or repeating instruments." S. Smith & Sons (Motor Accessories), Ltd., and E. B. Moss. April 21st, 1939. (529583.)

13080. "Electrical condensers." P. A. Sporing, F. C. Stephan and Telegraph Condenser Co., Ltd. May 2nd, 1939. (529375.)

13495. "Optical projection apparatus." General Electric Co., Ltd., V. J. Francis and W. R. Stevens. May 5th, 1939. (529377.)

14224. "Insulated electrical conductors." Rockbestos Products Corporation. September 10th, 1938. (529380.)

14467. "Thermionic valve circuits for the generation of a desired wave form." E. L. C. White. May 15th, 1939. (529383.)

14605. "Electric control of type-setting machines." Creed & Co., Ltd., and W. A. Mitchell. May 16th, 1939. (529389.)

14735. "High-speed switches for alternating current circuits." British Thomson-Houston Co., Ltd. May 17th, 1938 (Cognate application 14736/39.) (529396.)

14748. "Electrodeposition of manganese." Consolidated Mining & Smelting Co. of Canada, Ltd. July 14th, 1938. (529398.)

14826. "AC induction electricity meters." N. B. Coop and British Electric Meters, Ltd. May 18th, 1939. (529401.)

14922. "Electron-discharge valve amplifiers." A. H. Cooper and A. D. Blumlein. May 19th, 1939. (Cognate application 4858/40.) (529590.)

14976. "Lubricator devices particularly adapted for the lubrication of cams in electric ignition apparatus." Rotax, Ltd., and A. Massey-Allen. May 19th, 1939. (529445.)

14981. "Electric selector keys." Standard Telephones & Cables, Ltd. and W. H. M. Hellier. May 19th, 1939. (529446.)

14982. "Paper-tape recording equipment." Standard Telephones & Cables, Ltd., and A. Brown. May 19th, 1939. (529447.)

14991. "Glass to metal seals." British Thomson-Houston Co., Ltd. May 21st, 1938. (529593.)

15010. "Telephone systems." Automatic Telephone & Electric Co., Ltd., R. Taylor and G. T. Baker. May 19th, 1939. (529448.)

15014. "Electric circuits employing feedback." Electrical Research Products, Inc., and S. H. W. Browning. May 19th, 1939. (529595.)

15148. "High-frequency electric conductors." Felten & Guilleaume Carlswerke Akt.-Ges. June 27th, 1938. (529521.)

15395. "Gas-blast circuit breakers." Akt.-Ges. Brown, Boveri & Cie. May 27th, 1938. (529453.)

15514. "Shutters or shields for electric socket outlets." J. A. Crabtree & Co., Ltd., H. F. McLoughlin, B. G. Harrison and R. W. Morgan. May 25th, 1939. (Addition to 510377.) (529597.)

15705. "Radio antennae." Marconi's Wireless Telegraph Co., Ltd. May 28th, 1938. (529522.)

15759. "Television automatic amplification control system." Hazeltine Corporation. June 21st, 1938. (529319.)

15760. "Duplex vacuum tube repeaters." Hazeltine Corporation. July 13th, 1938. (529456.)

15761. "Television broadcast system." Hazeltine Corporation. June 9th, 1938. (529320.)

15769. "Electron-discharge devices." A. C. Cossor, Ltd., and E. E. Shelton. May 26th, 1939. (529523.)

15778. "Electric discharge tubes." Mullard Radio Valve Co., Ltd. May 30th, 1938. (529322.)

15798. "Suppressing or eliminating atmospheric or static interference in signalling or communicating apparatus." J. Cherrill. May 30th, 1939. (529325.)

15822. "Headlamps for vehicles and other lamps." R. Bosch Ges. May 30th, 1938. (529329.)

15835. "Mounting of electric fuses." G. Blount. May 30th, 1939. (529330.)

15885. "Braun tube." Radioakt.-Ges. D. S. Loewe. May 31st, 1938. (529341.)

15890. "Control arrangements for electric motors used to adjust regulators and the like." E. Friedlander. May 28th, 1938. (529343.)

15894. "Telegraph transmitting mechanism." A. H. Stevens (Western Union Telegraph Co.). May 30th, 1939. (529345.)

15895. "Telegraph systems." A. H. Stevens (Western Union Telegraph Co.). May 30th, 1939. (529346.)

15897. "Laryngaphones." Soc. Industrielle Radioélectrique. June 4th, 1938. (529347.)

15905. "Electric terminals." H. Fraenkel and Automatic Coil Winder & Electrical Equipment Co., Ltd. May 30th, 1939. (529349.)

15913. "Means for controlling winding and reeling apparatus for wire and the like." British Thomson-Houston Co., Ltd. May 28th, 1938. (529351.)

15914. "Electric crane, hoist and the like control systems." British Thomson-Houston Co., Ltd. May 31st, 1938. (529457.)

15917. "Arrangements employing electro-mechanical vibrating devices." Standard Telephones & Cables, Ltd. June 11th, 1938. (529352.)

15964. "Television transmitting cathode-ray tubes." Marconi's Wireless Telegraph Co., Ltd. May 31st, 1938. (529410.)

15965. "Television transmitting systems." Marconi's Wireless Telegraph Co., Ltd. May 31st, 1938. (529411.)

15979. "Furnace walls of water tube boilers." Bennis Combustion, Ltd., and A. W. Bennis. May 31st, 1939. (529414.)

16005. "Constant potential transformer." Sola Electric Co. August 31st, 1938. (529420.)

16044. "Lighting fittings comprising two glass members fitting against each other." General Electric Co., Ltd., and S. S. Beggs. May 31st, 1939. (529426.)

16048. "Control of electrically-operated soot-blowers." British Thomson-Houston Co., Ltd., and H. F. Jefferson. May 31st, 1939. (529598.)

16050. "Ignition systems for internal-combustion engines." British Thomson-Houston Co., Ltd., and T. F. Robinson. May 31st, 1939. (529458.)

16077. "Electron multipliers." Philips Lamps, Ltd. June 3rd, 1938. (529433.)

16081. "Electric heaters." Ungarische Radiatoren Fabriks Akt.-Ges., and S. Beck. May 31st, 1939. (529434.)

16105. "Method of and apparatus for the manufacture of fibrous tape for electrical insulating purposes." London Electric Wire Co. & Smiths, Ltd., and A. J. Sands. June 1st, 1939. (529464.)

16106. "Fibrous tape for electrical insulating purposes." London Electric Wire Co. & Smiths, Ltd., and E. L. Wildy. June 1st, 1939. (529465.)

16121. "Switches of the type used in telephone systems." General Electric Co., Ltd., and G. Dewar. June 1st, 1939. (529467.)

16131. "Method of producing sharply defined current impulses for the generation of ultra-short waves by means of electron tubes." G. Jobst. June 2nd, 1938. (Addition to 518665.) (529599.)

16144. "Frame aerials for radio communication apparatus." Fabbrica Italiana Magneti Marelli. June 3rd, 1938. (529470.)

16154. "Door-operated electric switches." Igranic Electric Co., Ltd. June 10th, 1938. (529475.)

16163. "Refrigerator cabinets." British Thomson-Houston Co., Ltd. June 1st, 1938. (529477.)

16164. "Combined electric fuses and remotely controlled cut-outs." British Thomson-Houston Co., Ltd. June 1st, 1938. (529478.)

16166. "Amplifying systems." British Thomson-Houston Co., Ltd. June 1st, 1938. (529479.)

16167. "Ignition apparatus for internal combustion engines." British Thomson-Houston Co., Ltd., and T. F. Robinson. June 1st, 1939. (529600.)

16168. "Electron microscopes." M. von Ardenne. June 1st, 1938. (529480.)

16188. "Apparatus for the electrical precipitation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Siemens-Lurgi Cottrell-Elektrofilter-Ges. für Forschung und Patentverwertung.) June 1st, 1939. (529485.)

16216. "Electrical dividing boxes." Cosway (Sales), Ltd., and G. P. Cosway. June 2nd, 1939. (529488.)

16239. "Shielded anode electron multiplier." Farnsworth Television & Radio Corporation. June 13th, 1938. (529496.)

16251. "Adjustable condensers for electrical measurements." H. W. Sullivan, Ltd., and W. H. F. Griffiths. June 2nd, 1939. (529501.)

16252. "Alternating current inductance bridges." H. W. Sullivan, Ltd., and W. H. F. Griffiths. June 2nd, 1939. (529525.)

16253. "Adjustable condensers for electrical measurements." H. W. Sullivan, Ltd., and W. H. F. Griffiths. June 2nd, 1939. (529526.)

16270. "Telephone systems." Siemens Bros. & Co., Ltd., D. P. Long and H. E. Humphries. June 2nd, 1939. (529534.)

(*Concluded on page* 168)

FINANCIAL SECTION

New Companies. Capital Returns. Debenture Charges. Bankruptcies and Liquidations. Reports and Dividends. Stocks and Shares

Company Registrations

Astral Engineering Co., Ltd.—Private company. Registered in Edinburgh, November 19th. Capital £3,000. Objects: To carry on the business of mechanical and electrical engineers, electricians, general engineers and contractors, etc. S. Stanger, 31, Colquhoun Drive, Bearsden, Dumbartonshire, signs documents as director. Registered office: 1359, Barrhead Road, Nitshill, Glasgow.

S.E.G., Ltd.—Private company. Registered November 26th. Capital £1,000 in 1,000 shares of £1 each. Objects: To carry on the business of designers, inventors, manufacturers, repairers and factors of, and sales agents for, and dealers in, electrical, magnetic, wireless, television, scientific instruments, etc. The directors are: E. C. Kent, 261, Norwood Road, Southall, Middlesex (permanent managing director) and two others. Secretary: A. D. Wells, 91, Boston Gardens, Boston Manor, Brentford, Middlesex.

Companies' Returns

Statements of Capital

Settle & District Electricity Co., Ltd.—Capital £100,000 in £1 shares. Return dated July 15th, 1940. 75,000 shares taken up. £75,000 paid. Mortgages and charges: Nil.

Revo Electric Co., Ltd.—Capital £500,000 in 10s. shares. Return dated July 17th, 1940. 735,000 shares taken up. £228,150 paid on 456,300 shares. £139,350 considered as paid on 278,700 shares. Mortgages and charges: Nil.

Electric Construction Co., Ltd.—Capital £400,000 in 100,000 preference and 300,000 ordinary shares of £1. Return dated July 25th, 1940. All shares taken up. £153,710 paid on 73,710 preference and 80,000 ordinary shares. £246,290 considered as paid on 26,290 preference and 220,000 ordinary shares. Mortgages and charges: £112,960.

West Cambrian Power Co., Ltd.—Capital £800,000 in £1 shares. Return dated July 29th, 1940. 615,000 shares taken up. £614,066 5s. paid (£1 on 614,066 shares and 5s. on 1 share). £933 15s. considered as paid (£1 on 933 and 15s. on 1 share). Mortgages and charges: Nil.

J. Dyson & Co., Ltd.—Capital £30,000 in 10,000 "A" ordinary and 20,000 ordinary shares of £1. Return dated July 22nd, 1940. 10,000 "A" ordinary and 18,100 ordinary shares taken up. £20,100 paid on 10,000 "A" ordinary and 10,100 ordinary shares. £8,000 considered as paid on 8,000 ordinary shares. Mortgages and charges: Nil.

Mortgages and Charges

Lacy Hulbert & Co., Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated November 9th, 1940, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Albert E. Sudlow & Co., Ltd.—First mortgage debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 25th, 1940, to secure all moneys due or to become due from the company to Martins Bank, Ltd.

New Process Welders, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated November 14th, 1940, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Receiver Released

Electric Shavers, Ltd.—J. C. Helme, 19, Devereux Court, W.C.2, ceased to act as receiver and manager on November 25th, 1940.

Liquidations

Henri Selmer & Co., Ltd.—Winding up voluntarily. Liquidator, Mr. P. Phillips, 14, Langham Street, London, W.1. This note is purely formal. All creditors have been, or will be, paid in full.

Weston Wireless, Ltd.—Meetings January 7th, pursuant to section 245 of the Companies' Act, 1929, at 32, London Wall, E.C.2, to receive an account of the winding-up by the liquidator, Mr. D. Mahony.

Bankruptcies

K. Bader, electrical equipment manufacturer, lately carrying on business at Westmorland Road, Hendon.—The public examination of this debtor was to be held on December 11th before Mr. Registrar Kean at the London Bankruptcy Court. Mr. C. T. Newman, Assistant Official Receiver, reported that the debtor and his wife were Germans and had been interned in the Isle of Man. The chief liability was £1,500 in respect of damages awarded to Funditor, Ltd., plus £1,000 costs of an action for libel.

The assets, it was stated, consisted of the equity of a house and certain shares which had been transferred to the debtor's wife. Mr. F. S. Salaman, who had been appointed trustee by the creditors, had informed the Official Receiver that he was not desirous of going to the expense of sending a clerk to Douglas, or of bringing the debtor to London. In those circumstances, the Official Receiver suggested that the examination should be adjourned generally. Order was entered accordingly.

T. P. Wood (a firm), electrical contractors, 28, Queen Street, Ipswich.—The public examination was held on December 6th at the Shire Hall, St. Helens, Ipswich. The statement of affairs disclosed gross liabilities of £2,749, of which £1,622 was expected to rank for dividend, with net assets of £253, leaving a deficiency of £1,369. It was stated that the partners in the firm were Thomas Percy Wood and Thomas George and the partnership was commenced in 1935. Between 1936 and 1939 the turnover averaged £6,000 per annum, but since then the takings had declined. The failure was attributed to loss of contracts owing to the war. The examination was closed, subject to the signing of the notes.

J. W. Roberts, electrician, 19, Twiss Green Lane, Culcheth, Lancs.—At the Court House, Mawdsley Street, Bolton, recently, this debtor applied for his discharge, which was granted, subject to three months' suspension. The receiving order was made in 1936. Apparently the debtor had traded for about thirty years, but he was the victim of the cotton slump.

H. J. Gill, electrical engineer and radio dealer.—Receiving order made November 22nd on debtor's own petition.

A. E. Carter, electrical contractor, 10, Pages Lane, Muswell Hill, London, N.10.—Discharge suspended for four months until February 23rd, 1941.

Reports and Dividends

The General Cable Manufacturing Co., Ltd., reports a profit for the year to September 30th of £61,007 as compared with £25,970 for the preceding year. After deducting £2,897 for depreciation and £860, fees, there is a net balance of £56,249 (against £22,584). Taxes require £37,350 and the final ordinary dividend is 9 per cent., making 15 per cent. for the year (against 12 per cent.). Reserve receives £4,000 and £2,012 is carried forward (against £1,862 brought in).

Acquisition of Dollar Securities.—A further list of American stocks which are required

---

New Patents (*Concluded from page 167*)

16271. "Electromagnetically controlled indicators for displaying variable information." Siemens Bros. & Co., Ltd., J. H. Broome, A. F. Wood and A. A. Southam. June 2nd, 1939. (529535.)

16273. "Water cooled high pressure metal vapour electric discharge devices." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Gluhlampen). June 2nd, 1939. (529536.)

16282. "Tubular resilient gripping devices." Standard Telephones & Cables, Ltd. June 4th, 1938. (529538.)

16283. "Systems for transmission of electro-magnetic waves at very high frequencies." Standard Telephones & Cables, Ltd. June 29th, 1938. (529539.)

16304. "Radio direction finders." Telefunken Ges. für Drahtlose Telegraphie. June 4th, 1938. (529542.)

16319. "Electric resistance welding installation." B. Berghaus. June 3rd 1938. (529545.)

16359. "Electrical ignition apparatus." British Thomson-Houston Co., Ltd., K. J. R. Wilkinson and R. T. Coe. June 3rd, 1939. (529558.)

16364. "Electric distribution units for pillars, panels and the like." W. T. Henley's Telegraph Works Co., Ltd., and W. A. T. Crowe. June 3rd, 1939. (529559.)

16380. "Cathode ray oscillographs." M. von Ardenne. June 3rd, 1938. (529560.)

16387. "Earthing arrangements of electric switches, particularly for cooking appliances." C. A. Turner and Diamond H Switches, Ltd. June 3rd, 1939. (529603.)

16443. "Magneto electric generators." Magnetos Lucifer Soc. Anon. September 2nd, 1938. (529621.)

16456. "Electric inverting systems." E. Friedlander. June 4th, 1938. (529625.)

16461 "Electric heating elements." British Thomson-Houston Co., Ltd., and W. J. Sims. June 5th, 1939. (529627.)

16462. "Synthetic resinous compositions, and methods of making the same." British Thomson-Houston Co., Ltd. June 4th, 1938. (529628.)

1940

2587. "Gravity controlled switch in association with electric torches." H. G. Rodway. February 10th. 1940. (529572.)

STOCKS AND SHARES

TUESDAY EVENING

STOCK Exchange markets have been heartened by the successful operations of the Forces in the Western Desert and the nearer East. The flow of investment capital into gilt-edged stocks can be indicated by the strength of British Government securities. Central Electricity issues are again in request. The 3½ per cent. 1963-93 stock is better at 93. London Passenger Transport senior stocks are difficult to obtain.

Announcement of the terms of the Government's plan for compulsory insurance of property against war damage has had little quotable effect upon prices. It evoked a good deal of discussion, from the tenor of which it would appear that the terms are considered to be, as a whole, fair and reasonable. The volume of business that passes daily in the markets can be described, in schoolboy phrase, as " nothing to write home about." The strength of prices, in the face of this quietude of business, is significant of the assurance felt as to the outcome of the war.

The War Damage Bill

The Bill providing for compulsory insurance against war damage excludes the public utilities and the railways. These two groups are subject to a special scheme which will shortly be brought before Parliament, but the contributions are to be broadly equivalent to those payable in respect of properties in general. This compulsory insurance means, of course, an extra tax, in addition to existing burdens. As it is to be retrospective, the compensation that will be recoverable after the war, or sooner, is a protection for which the rate of 10s. per cent. of Income Tax Schedule A, or net rateable, valuation, spread over five years, is considered to be not too heavy. In what manner the insurance scheme will work out it is, of course, impossible to do more than estimate very vaguely.

The Strength of Prices

Thanks to the victorious advance of British and Greeks in the war areas, Palestine Electric " A " shares have risen 3s. 9d. to 15s. Jerusalem Electric ordinary remain at 17s. 6d. Calcutta Electrics have further hardened to 31s. 6d. on demand from investors attracted to shares upon which the dividends are generally paid free of tax. Perak Hydro-Electrics have been changing hands up to 17s.: the official middle price of 16s. 3d. shows $\frac{1}{16}$ gain. In the Home list, advances have occurred in the ordinary shares of the British Light & Power, Metropolitan, North Eastern, Scottish and Yorkshire companies. The Cable and Wireless stocks are steady. Globe ordinary at 26s. 3d. and the preference at 25s. have each put on $\frac{1}{16}$. Southern Railway preferred is a point harder at 46½. London Passenger " C " holds its recent rise to 33.

The manufacturing group is quietly firm. Amongst the few changes, English Electrics at 30s., Telephone Manufacturing at 7s. and Tube Investments at 87s., are better. Victoria Falls ordinary shares firmed up to 70s. upon declaration of an interim dividend of 4 per cent. A similar rate was paid a year ago, followed by a final of 11, making 15 per cent. for the year.

South London Debenture

To those who are seeking a first-class debenture stock, mention of £3,000 South London Electric Supply 4½ per cent. at 105½ ex dividend, may be of service. The stock is redeemable at 100 in 1972, or after 1964, at 100. Assuming repayment at the earlier date—1965—the yield at the present price works out to £4 2s. 9d. per cent., but the flat return comes to 4¼ per cent. The issue requires £13,500 for its annual service. The amount available for distribution in the last published accounts was £148,000. If the stock runs to its full term of 1972, the redemption yield will be, of course, raised above the £4 2s. 9d. just quoted.

Southern Areas

Looking at the yields offered by the ordinary shares in electricity supply companies, it will be noticed that Southern Areas return the high rate of £6 18s. per cent. on the basis of the last paid dividend of 5 per cent. The interim dividend this year was deferred until the final figures were available, a step which may have been prompted by the fact that distribution of a 2 per cent. interim dividend, the same as that of the corresponding period last year, would have entailed the expenditure of a good deal of work and stationery. It scarcely seems worth while to go to this expense for the sake of a small dividend and this probably weighed with the board in its decison to defer the dividend. It is expected that the company will be able to declare 5 per cent. for the year.

Also affording a high yield are County of London ordinary shares, where the return at 31s. 6d. is £6 13s., assuming maintenance of the dividend of 10½ per cent. paid for some years past. The company distributed an interim dividend of 3 per cent., the same as usual, but it is generally assumed, as already mentioned here, that the final will be reduced. It is thought, too, that the Metropolitan Electric Supply Co. may make a cut in its last-paid 10 per cent. dividend, which compared with 12 per cent. in the two previous years. If the 10 per cent. dividend is continued, the yield at the current price will be £6 7s. per cent. The Northmet Power Co. has paid 10 per cent. annually for several years past, but the interim this year was reduced from 4 per cent. to 3 per cent., and this, as previously indicated, hints at a possible reduction in the dividend for the year.

Five Per Cent. Yields

The shares in companies whose dividends are not likely to be affected, *e.g.*, Clyde Valley, Edmundsons, Scottish Power, Lancashire Electric, give returns ranging from 4½ per cent. to 5½ per cent. on the money, but scarcity of supply is still a feature in regard to them. Edmundsons are available as to about 5,000 shares, but in the case of the others, the number on offer is limited, as a rule, to 250 to a thousand shares.

By way of exception, two thousand North Eastern Electric Supply ordinary shares of £1 each are offered at 25s., with a final dividend for the current year due in March, 1941. The yield is £5 12s. per cent. on the basis of the 7 per cent. dividend which has been paid annually for the last four years. The company is one of the largest producers of electricity in the United Kingdom.

The Stock Exchange Filmed

Some time next week or, at any rate, early in the New Year, there will be a general release of the film taken early this month n the Stock Exchange, of the House at work in wartime. A private view of the film was exhibited to a number of Stock Exchange Managers a few days ago, and the completed picture is likely to attract wide interest.

The decision to allow a cinema picture to be taken of the Stock Exchange at work was reached by the Managers and Committee of the House after a certain amount of discussion and criticism. By one of the rules of the Stock Exchange, members are not allowed to advertise, and the tradition which has grown up around this regulation has led to a marked distaste for anything that savours of publicity. Seeing, however, that Lloyds had been filmed a few weeks ago, it was agreed that a similar picture of the Stock Exchange at work might prove a useful, as well as an interesting, record of daily life in the House.

Dividends and Prices

With the approach of every year-end, the question arises as to whether it is better to buy stocks and shares cum the dividends, of which so many are declared at this time, or if the buyer would find it cheaper to wait until the prices went ex dividend. To this query it is, as a matter of fact, impossible to reply with a hard and fast rule. The decision must rest with the individual. Some people love to handle dividend-warrants personally: apparently it gives them an added sense of proprietorship. Others think that, as the previous holder of the shares is likely to wait for the price to go ex dividend before parting from his interest, the natural result will be to bring in more sellers than buyers, thereby depressing the price. Stockbrokers are constantly asked what is the general tendency of prices as this is likely to be influenced by dividend deductions.

It must be remembered that the amount deducted for the dividend is, as near as possible, the exact money that is paid. For example, if a half-yearly dividend is £3 less 8s. 6d. in the £, the ex dividend deduction will be 1¾ from the price of the stock. The same principle is applied to shares, but it is, of course, impossible to take off the precise amount where the latter comes to, say, 3¼d. or 9½d. per share. The ex dividend price is made as close as the jobbers can get it to what the quotation was prior to the distribution being deducted. In other words, there is so little difference as a rule, between the cum dividend and its relative ex dividend price, that it matters little, from the practical point of view, whether the buyer deals cum or ex. This being the case, the question as to which is the better way to buy (or sell) shares—cum dividend or ex—is a matter for individual decision in each transaction.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Dec. 16	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies							
Bournemouth and Poole	63/6	36/6	15	15	43/9	..	—
British Power and Light	30/–	20/–	7	7	26/–	+6d.	5 7 8
City of London	28/–	20/–	7½	7½	21/3	..	—
Clyde Valley	38/6	24/–	8	8	33/9	..	4 14 10
County of London	43/3	21/–	10½	10½	30/9	..	6 16 7
Edmundson's:							
7% Pref.	32/–	24/3	7	7	28/3	..	4 19 1
Ord.	27/6	18/6	9	6	23/6xd.	..	5 2 2
Elec. Dis. Yorkshire	40/3	32/–	9	9	32/6	..	5 10 9
Elec. Fin. and Securities	42/–	34/6	12½	12½	38/9	..	6 15 0
Elec. Supply Corporation	48/–	39/–	12	11½	37/–	..	6 4 4
Isle of Thanet	16/–	5/6	4	4	6/–	..	—
Lancs Light and Power	33/–	21/6	7½	7½	27/6	..	5 9 1
Llanelly Elec.	21/–	17/–	5½	5½	18/–	..	6 2 5
Lond. Assoc. Electric	21/–	12/6	7	5½	13/9	..	—
London Electric	35/–	19/–	8	7	20/–	..	7 0 0
London Power Deb. Red.	105½	100	5	5	101½	+1	4 18 6
Metropolitan	41/6	22/6	12	10	31/3	..	6 10 0
Midland Counties	39/–	23/3	8	8	32/6	..	4 18 6
Mid. Elec. Power	40/–	29/6	9	9	33/9	..	5 6 8
Newcastle Elec.	29/9	22/6	7	7	22/6	..	6 7 3
North Eastern Elec.:							
Ordinary	31/6	16/6	7	7	25/–	+⅛	5 12 0
7% Pref.	32/6	25/6	7	7	28/3	..	4 19 1
Northampton	44/–	38/–	10	10	40/–	..	5 0 0
Notting Hill 6% Pref. (£10)	10½	9	6	6	9	..	—
Northmet Power:							
Ordinary	42/3	22/6	10	10	30/9	..	—
6% Pref.	29/–	23/–	6	6	26/6	..	4 10 7
Richmond Elec.	24/6	18/–	7	6	18/9	..	—
Scottish Power	38/–	24/–	8	8	33/3	+9d.	4 16 3
Southern Areas	21/3	12/9	5	5	14/6	..	6 18 0
South London	23/3	20/–	7	7	20/–	..	7 0 0
West Devon	20/–	17/6	5	5	20/–	..	5 0 0
West Glos.	22/–	15/–	2½	4½	16/3	..	5 10 10
Yorkshire Elec.	40/–	23/6	8	8	33/3	+9d.	4 16 3
Overseas Electricity Companies							
Atlas Elec.	4/–	1/3	Nil	Nil	1/9	..	—
Calcutta Elec.	37/–	22/6	10*	8*	31/6	+6d.	5 1 7
Cawnpore Elec.	30/–	24/–	10	10	26/3	..	7 12 4
East African Power	25/6	19/6	7	7	20/9	..	6 15 0
Jerusalem Elec.	24/–	15/–	7	7	17/6	..	8 0 0
Kalgoorlie (10/–)	12/6	9/6	7½	7½	11/6	..	6 10 5
Madras	26/9	21/6	8*	6*	25/–	..	—
Montreal Power	35½	30	1½	1½	32	..	—
Palestine Elec. "A"	25/–	10/–	5*	Nil	15/–	+⅛	—
Perak Hydro-electric	20/3	13/–	2½	6	16/3	+6d.	7 7 8
Shawinigan Power	27¼	19	83cts.	90cts.	20	..	—
Tokyo Elec. 6%	69	52	6	6	30	..	20 0 0
Victoria Falls Power	75/9	56/6	15	15	70/–	+⅛	4 5 9
Whitehall Investments Pref.	17/9	8/–	7½	7½	10/–	..	15 0 0
Public Boards							
Central Electricity:							
1950–70	110½	104	5	5	109	..	4 11 9
1955–75	112½	106	5	5	110	..	4 11 0
1951–73	107½	102	4½	4½	105xd.	..	4 5 9
1963–93	96½	90	3½	3½	93	+½	3 15 3
London Elec. Trans. Ltd.	92	87½	2½	2½	93	..	2 15 9
London & Home Counties 1955–75	113½	105	4½	4½	105½	..	4 5 4
Lond. Passenger Transport:							
A	116	104	4½	4½	107xd.	..	4 4 0
B	116	102½	5	5	104	..	4 15 8
C	65½	25	1½	1½	33	..	4 11 0
West Midland Joint Elec. 1948–68	106½	103	5	5	105½	..	4 14 9
Telegraph and Telephone							
American Tel. & Tel.	230	176	9	9	200	..	4 10 0
Anglo-Am. Tel.:							
Pref.	107	85	6	6	97	+½	6 3 9
Def.	23½	18	1½	1½	22½	..	6 13 4
Anglo-Portuguese	22/6	10/–	8	8	15/–	..	10 13 4
Cable & Wireless:							
5½% Pref.	99½	66	4½	5½	92	..	5 19 7
Ord.	65	27	4	4	55½	..	7 4 4
Income	99½	93	..	..	98½xd.	..	4 1 3
Canadian Marconi $1	6/–	4/–	Nil	4cts.	4/6	..	—
Globe Tel. & Tel.:							
Ord.	32/6	21/6	7½*	6*	26/3	+⅛	4 11 5
Pref.	27/9	22/6	6	6	25/–xd.	..	4 16 0
Great Northern Tel. (£10)	20	11	20	20	12½	+⅛	—
Inter Tel. & Tel.	5½	2½	Nil	Nil	3½	..	—
Marconi-Marine	30/–	18/3	10	7½	19/6xd.	..	7 13 10
Oriental Telephone Ord.	2¾	45/–	12*	11½*	2¾	..	4 16 10
Telephone Props.	15/–	11/–	5	6	11/3	..	10 13 4
Telephone Rentals (5/–)	9/6	5/3	10	10	7/3	+3d.	6 18 0

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Dec. 16	Rise or Fall	Yield p.c. £ s. d.
Traction and Transport							
Anglo. Arg. Trams:							
First Pref. (£5)	4/3	1/–	Nil	Nil	2/–	..	—
4% Inc.	11½	2	Nil	Nil	9	..	—
British Electric Traction:							
Def. Ord.	830	400	5	45	750	..	6 4 4
Pref. Ord.	169	130	8	8	140	..	5 14 3
Bristol Trams	48/6	32/6	10	8*	37/6	..	—
Brazil Traction	12½	5½	$1	50c.	5½	..	—
Calcutta Trams	24/–	16/3	8	5½	19/–	..	5 15 9
Cape Elec. Trams	18/6	16/–	5	5	17/–	..	5 17 8
Lancs Transport	35/–	27/6	10	10	35/–	..	5 14 3
Mexican Light:							
1st Bonds	36	25	5	5	30	..	—
Rio 5% Bonds	95	74	5	5	85	..	5 17 8
Southern Rly.:							
5% Prefd.	79	35	5	5	46½	+1	10 15 0
5% Pref.	104½	59	5	5	83½	..	5 19 9
T. Tilling	45/9	29/–	10	10	39/6	..	5 1 3
Tilling & B.A.	47/6	41/9	9*	8*	44/6	..	—
West Riding	35/–	25/–	10	10	33/6	−6d.	5 19 5
Equipment and Manufacturing							
Aron Electricity Ord.	17/6	10/–	15	Nil	15/–	..	—
Assoc. Elec.:							
Ord.	43/3	26/6	10	10	40/–	..	5 0 0
Pref.	36/6	32/3	8	8	35/–	..	4 11 5
Automatic Telephone & El.	47/3	32/–	12½	12½	40/–	..	6 5 0
Babcock & Wilcox	50/–	28/6	10	11	39/6	..	5 11 2
British Aluminium Ord.	56/–	29/–	12½	12½	40/9	−6d.	—
British Insulated Ord.	92/6	67/–	20	20	81/3	..	4 18 6
British Thermostat (5/–)	14/9	6/6	18½	18½	11/3	..	8 4 6
British Vacuum Cleaner (5/–)	12/–	4/9	40	12½	6/3	..	10 0 0
Brush Ord.	4/8	1/9	Nil	Nil	3/9	..	—
Callender's	69/–	46/–	15	15	62/6	..	4 16 0
Chloride Elec. Storage	72/6	55/–	15	15	60/–	..	5 0 0
Consolidated Signal	72/6	59/–	36½	17	60/–	..	5 13 4
Crabtree (10/–)	24/9	17/6	17½	17½	22/6	..	7 15 7
Crompton Parkinson:							
Ord. (5/–)	20/–	12/–	30	20	17/6	..	5 14 3
E. K. Cole (5/–)	5/–	2/6	10	Nil	4/6	..	—
Elec. & Musical Industries (10/–)	10/3	4/3	5	Nil	7/6	..	—
Electric Construction	36/3	27/6	13½	10	27/6	..	7 5 6
Enfield Cable Ord.	56/–	40/6	25	16½	45/–	..	7 5 5
Electrical Switchgear (10/–)	22/6	20/–	16	10	20/–	..	5 0 0
English Electric	33/9	16/6	10	10	30/–	+⅛	6 13 4
Ensign Lamps (5/–)	15/3	12/6	25	25	15/–	..	8 6 8
Ericsson Tel. (5/–)	39/3	23/–	25*	25*	32/6	..	—
Ever Ready	28/3	16/6	30	40	25/6	..	7 16 10
Falk Stadelmann	18/3	12/6	6	7	13/9	..	10 3 8
Ferranti Pref.	25/–	22/–	7	7	23/9	..	5 18 0
G.E.C.:							
Pref.	32/6	26/–	6½	6½	30/–	..	4 6 8
Ord.	83/3	53/3	20	20	77/–	..	5 4 0
Greenwood & Batley	25/6	20/–	15	15	20/–	..	13 0 0
Hall Telephone (10/–)	18/6	8/9	15	10	11/3	..	8 18 0
Henley's (5/–)	21/6	12/6	20	20	18/9	..	5 6 8
4½% Pref.	21/2	20/6	4½	4½	21/3	..	4 4 8
Hopkinsons	46/9	32/6	12½	15	38/9	..	7 14 10
India-Rubber Pref.	21/–	19/6	5½	5½	20/–	..	5 10 0
Intl. Combustion	121/3	70/–	32½	32½	4½	..	7 17 9
J. Lucas	60/6	40/–	15	15	48/9	..	6 3 4
Johnson & Phillips	50/9	32/6	12½	15	45/–	..	6 13 4
Lancashire Dynamo	59/9	47/6	25	20	47/6	..	8 8 5
Laurence Scott (5/–)	11/–	6/–	15	15	7/–	..	10 14 2
London Elec. Wire	25/6	20/–	7½	7½	22/6	..	6 13 4
Mather & Platt	46/6	30/–	13½	10	34/6	..	5 16 0
Metropolitan Elec. Cable Pf.	22/–	21/3	5½	5½	21/3	..	5 3 6
Murex	86/9	52/6	20	20	78/9	..	5 1 6
Pye Deferred (5/–)	9/–	6/9	25	25	8/9	..	14 5 8
Revo (10/–)	20/9	11/6	17½	5	17/6	..	2 17 6
Reyrolle	60/6	41/–	12½	12½	46/3	..	5 8 2
Siemens Ord.	23/9	15/6	7½	7½	17/6	..	8 11 6
Strand Elec. (5/–)	2/3	9d.	10	4	1/3	..	16 0 0
S. Smith (1/–)	8/–	3/6	37½	50	7/6	..	6 13 4
Switchgear & Cowans (5/–)	11/9	5/6	20	10	7/6	..	6 13 4
Telegraph Condenser (10/–)	8/9	6/3	5	..	7/6	..	—
Telegraph Construction	42/6	29/–	10	10	33/9	..	5 18 6
Telephone Mfg. (5/–)	9/–	5/–	9	9	7/–	+1/–	6 8 7
Tube Investments	96/9	59/–	23½	23½	87/–	+6d.	5 10 4
Vactric (5/–)	3/6	2/–	4	Nil	2/3	..	—
Vickers (10/–)	22/–	9/6	10	10	14/9	+3d.	6 15 7
Ward & Godstone (5/–)	19/9	12/6	20	20	12/6	..	8 0 0
Westinghouse Brake	46/–	30/6	17½	10	37/6	..	5 6 8
Walsall Conduits (4/–)	26/6	17/6	55	55	23/9	..	9 5 0
West, Allen (5/–)	7/–	3/–	7½	10	3/9	..	10 0 0

* Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Great George Street, London, S.W.1.

Kilkenny. — December 30th. County Board of Health and Public Assistance. Duplicate pumping equipment, electric motors, switchgear, etc., in connection with the Johnstown and Urlingford water supply. Specifications from T. Kelly, Engineer's Office, Central Hospital, Kilkenny (deposit, £5 5s.). Tenders to the Commissioner of the Board.

New Mills.—December 30th. Electricity Department. 11,000 V switchgear. (December 13th.)

Newport (Isle of Wight).—December 23rd. Corporation. Two electrically driven booster pumping sets, together with all incidental suction and delivery piping, valves, etc. Particulars, specification, and form of tender from H. G. W. Cook, borough engineer and surveyor, 38, Quay Street (deposit: £2 2s.). Tenders to R. Preston, town clerk, Municipal Offices, 17, Quay Street.

New Zealand. — WELLINGTON. — Public Works Department. January 14th. Two 3,000-kVA, 11-kV, three-phase, 50-cycle outdoor-type voltage regulating transformers and control equipment. (T.22238/40.)*

January 29th. Post and Telegraph Department. Condensers, conductor cords and headbands. (T. 23413/40).*

South Africa.—PRETORIA.—Union Tender & Supplies Board. January 4th. Plant at Gasworks, Cottesloe: (a) One 200-kW rotary converter and associated equipment. Alternatively (b) one 200-kW mercury arc rectifier or (c) two 100-kW mercury arc rectifiers. (d) Equipment for spare power circuit frame. (T.22424/40.)*

January 30th. Union Tender & Supplies Board. 200 lightning protectors. (T.23336/40.)*

January 16th. One 5-kW, 220/380-V alternator, direct coupled to a water-cooled petrol engine. (T.23310/40.)*

CAPE TOWN.—January 28th. Electricity Department. Three oil-immersed single-phase 270-kVA transformers. (T.23173/40.)*

January 29th. Air conditioning plant. (T. 23387/40).

Orders Placed

Barrow-in-Furness. — Watch Committee. Accepted. Electrical door opening equipment for central fire station (£51 10s. per set, exclusive of fitting).—Newgate Engineering Co.

Brighton.—Electricity Committee. Accepted. Duplicate circulating water pump (£3,005).—Mather & Platt.

Cardiff.—Electricity Committee. Accepted. Telephone cable for Rhymney river water scheme (£175).—Siemens Bros. Metering equipment (£595).—Chamberlain & Hookham.

Health Committee. Accepted. Battery reconditioning at Mental Hospital (£356).—Tudor Accumulator Co.

Carlisle.—Electricity Committee. Accepted. Coal and ash handling plant.—Stirling Boiler Co.

Darlington.—Electricity Committee. Accepted. Disconnecting boxes (£559).—W. T. Henley's Telegraph Works Co.

Glasgow.—Police Committee. Accepted. Supply of loud speaker equipment (£42).—W. S. Steele.

Hove.—Electricity Committee. Recommended. Switchgear (£578). — Switchgear and Cowans.

Leeds.—Electricity Committee. Accepted. Switchgear.—Yorkshire Switchgear & Engineering Co.

Lincoln.—Finance Committee. Accepted. "Telematic" internal telephone installation at Corporation offices.—Telephone Rentals.

London.—METROPOLITAN WATER BOARD. —Works Committee. Accepted. Cable for coal handling plant (£70).—Crompton Parkinson.

BETHNAL GREEN. — Emergency Committee. Accepted. Exhaust fans for shelters (£181).—Heatovent Electric. Renewal of electric vehicle battery (£63).—Chloride Electrical Storage Co.

SOUTHWARK.—Electricity Committee. Recommended. Cable for twelve months.—Scottish Cables.

WESTMINSTER.—City Council. Recommended. 392-Ah capacity traction battery (£220).—D. P. Battery Co.

Newport (Isle of Wight).—Town Council. Accepted. Installation of electric lighting in school shelters (£769)—Isle of Wight Electric Light & Power Co.

Paisley.—Corporation. Accepted. Electrical installation at new water filter house. —Livingston, Scott & Co.

Portsmouth.—Health Committee. Accepted. Morrison electric delivery van (£342).—Wadham Bros.

Wakefield.—Education Committee.—Accepted. Electrical installation at technical college workshops (£97).—H. Goodyear.

Wexford.—Board of Health. Accepted. Electrical installation at laundry at Brownswood (£1,026).—Electricity Supply Board.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editor.

Aberdeen.—Completion of 150 houses, for T.C.; city architect, Town House.

Aberfeldy (Perthshire).—Air-raid shelters (electric lighting and heating); burgh surveyor.

Ardwick. — Works extensions; David Moseley & Sons, Ltd., Chapelfield Works, Dolphin Street.

Ashton-in-Makerfield. — Houses (76), Rectory Road, for U.D.C.; A. K. Dennis, surveyor, Council Offices.

Atcham.—Conversion, Attingham Park, for offices; Pearl Assurance Co., Ltd., Holborn, W.C.1.

Banstead.—Shelter tunnels, for U.D.C.; F. H. Wiltshire, clerk, The Council House, Brighton Road.

Bilston (Staffs.).—Conversion of Innisfallen into occupation centre, for C.C.; county architect, County Buildings, Stafford.

Blackburn.—Shelters at 15 elementary schools, Technical College, etc., for E.C.; director of education, Education Department.

Bradford.—School kitchens; city engineer.

Bridgnorth.—Mortuary, for T.C.; borough engineer, Municipal Offices, Bridgnorth.

Brierfield.—Cleansing station, Walter Street School; U.D.C. surveyor.

Brighton.—Partial rebuilding; J. Sainsbury, Ltd., 66 Western Road.

Bromley.—Eleven public air-raid shelters (50–100 persons each), for T.C.; S. Critchley Auty, town clerk, Municipal Offices.

Additions, Wray's Optical Works, Ashgrove Road; R. J. Ward.

Carlisle.—Staff hostel, Kingmoor; L.M.S. Railway Estates.

Chelmsford. — Bomb - proof shelters (£350,000) for T.C.; borough engineer, Municipal Offices.

Financial Section (*Concluded from page 168*).

to be handed over to the Treasury was issued last Saturday. They include securities of the American Gas and Electric Co., the Boston Edison Co., the Detroit Edison Co., the Electric Bond & Share Co., the National Power & Light Co., the Pacific Gas & Electric and the Southern California Edison Co.

Marco Refrigerators, Ltd., reports a trading profit for the year to September 30th of £21,099, as compared with £6,895 for 1938–39. After deducting expenses, fees and depreciation, there is a balance of £15,627 (against £3,967). A dividend of 7½d. per share is paid and the balance carried forward is £13,307 (against £961 brought in).

John I. Thornycroft & Co., Ltd., report that after providing for depreciation and taxation there is a profit of £160,334 for the year ended July 31st, as compared with £195,215 for the preceding year. After deducting directors' fees, debenture interest and benevolent fund contribution, there is a profit balance of £141,977 (against £169,171). The final dividend on the participating preferred ordinary shares is 3¾ per cent., making 7½ per cent., and the dividend on the ordinary shares is maintained at 10 per cent. for the year. Reserve receives £67,450, and the balance carried forward is £67,653 (against £53,877 brought in).

The East African Power & Lighting Corporation, Ltd., is maintaining its interim dividend at 3 per cent.

The Electric & General Investment Co., Ltd., is maintaining its interim dividend at 2½ per cent.

Lisbon Electric Tramways Ltd. is to pay an interim dividend of 2 per cent. tax free (same) on its ordinary capital.

The Electric Furnace Co. has declared an interim dividend of 3½ per cent. (unchanged).

Strand Electric Holdings, Ltd., is paying an interim dividend of 2 per cent. (against 4 per cent.).

The Victoria Falls and Transvaal Power Co., Ltd., is again paying an interim ordinary dividend of 4 per cent. less tax.

Chesterfield.—Alterations to "Rye Flatt," Oakwood Avenue, for E.C.; C. Bond, architect, 71A, Low Pavement.

Clayton-le-Moors.—Shelters (2,000 persons); surveyor, U.D.C. Offices.

Crickhowell. — Water supply scheme (£3,721), for R.D.C.; Thomas Morgan & Partners, engineers, Pontypridd.

Devizes.—Flax processing factory for English Flax Ltd.; J. E. Hoskins.

Edinburgh.—Garage and workshop extension, 1 Ravelston Place; R. Coll & Son, Ltd., builders, 28, Queen Street.

Workshop alterations, Russell Road; W. Arnott M'Leod & Co., builders, Russell Road.

Alterations, Tanfield Printing Works; Morrison & Gibb, Ltd.

Enfield.—Factory additions, Wharf Road; Enfield Furniture Manufacturing Co.

Factory extension, Alexandra Road; J. Henderson & Co.

Canteen, &c., Enfield Cable Works, Millmarsh Lane; T. Towers.

Erith.—Underground shelters (2,000 persons each), Fraser Road and Franks Park, or alternatively for 5,000 persons at Fraser Road; borough engineer, Town Hall, Erith.

Flookborough.—Social hall and canteen for Y.M.C.A.; H. & J. R. Bradshaw, builders, Hill Lane, Blackley, Manchester.

Glasgow.—Alterations, Botanic Picture House, Hillhead; Botanic, Ltd.

Halifax.—Houses, Backhold Lane (30) and Charlestown (24), for T.C.; town clerk, Town Hall.

Houghton-le-Spring.—Deep shelters; V. J. Hunter, U.D.C. surveyor.

Kettering.—Alterations and additions to factory, Victoria Street, and alterations, Bath Road; Upsons, Ltd.

Lancaster. — Works laboratory, Caton Road; Standfast Printers and Dyers, Ltd.

Leatherhead.—Public surface shelters (1,000 persons); L. Davies, U.D.C. surveyor, Council Offices.

Leicester.—Communal wash-houses scheme, for evacuees; city surveyor, Town Hall, Leicester.

London.—LEWISHAM.—Alterations, etc., to office at Town Hall, and additional accommodation at depot buildings, for B.C.; borough engineer, Council Offices, Town Hall, Catford, S.E.6.

Louth.—Alterations to sanitary block, King Edward VI Grammar School, for Lindsey E.C.; P. W. Birkett, county architect, County Offices, Lincoln.

Manchester. — Extensions, Withington, Crumpsall and Booth's Hall Hospitals; G. N. Hill, city architect, Town Hall.

Mansfield.—Office extensions; Portland Laundry Co., Ltd., Nottingham Road.

Market Drayton.—Houses, Stokes Hall Farm, for R.D.C.; H. Wainwright, surveyor, Council Offices.

Meltham.—Dairy, Colders Farm; F. Redfearn.

Meltham.—Fire station for U.D.C.; S. C. Drabble, surveyor, Council Offices.

Middlesbrough.—Warehouse, Union Street, for J. Meredith & Son; Kitching & Co., architects, 21, Albert Road.

Montrose.—Reconstruction of premises at Waterside for Chivers & Sons, Ltd.; Manager.

Morden.—Protective works, St. Helier Hospital (£12,000). School shelters (£8,444); Surrey county architect.

Morpeth.—Extensions, Sanderson House, Bridge Street; Alderman W. S. Sanderson.

Newcastle-on-Tyne. — Tunnel shelter, Scotswood Road (£25,000), for City Council; P. Parr, city engineer.

Northampton.—Houses (58), for R.D.C.; surveyor, Council Offices, 1, Spencer Parade.

Ormskirk.—Decontamination station, for U.D.C.; J. Taylor, clerk, Council Offices, Burscough Street.

Oswaldtwistle.—Communal shelters (7,000 persons) for U.D.C.; J. P. Shorrock, surveyor, Town Hall.

Oxford.—Bakery, 288, Abingdon Road; Cripps and Stewart, architects, 123, London Road, Oxford.

Bakehouse extensions, Old Headington; T. H. Kingerlee & Sons, Ltd., builders, 35, Queen Street, Oxford.

Offices, 66, Banbury Road; Symm & Co., builders, Little Clarendon Street.

Poulton.—Canteen and recreation room, near District Bank; Poulton Ladies' Red Cross Committee.

Poynton (Cheshire).—Conversion of cinema Clumber Street junction, into church and hall; Hill, Sandy and Norris, architects, 9, Albert Square, Manchester.

Preston.—330 communal shelters for 14,280 persons (£37,150), for T.C.; J. E. Foster, borough surveyor, Town Hall.

Redhill.—Protective works, County Hospital (£2,500); Surrey county architect.

Rochester (Kent).—New church, Maidstone Road; R.C. Authorities.

Rochford.—Shelter schemes for several parishes (£36,438); surveyor, Old Court.

Rotherham.—Extensions, A.F.S. stations for T.C.; V. Turner, borough engineer, Town Hall.

Saddleworth.—Communal huts for evacuees (50 persons each), for U.D.C.; surveyor, Council Offices, Uppermill, Saddleworth.

Sheffield.—Re-building forge, Sheaf Street; George Senior & Sons, Ltd., Ponds Forge.

Southend-on-Sea.—Annexe, Main Control Centre, for T.C.; R. G. Baxter, borough engineer, Municipal Buildings, Southend-on-Sea.

Southport.—Business premises alterations, Hall Street, for Jas. Hall & Co.; J. G. Wilkinson, builder, 12, Forest Road.

Day nursery, King Street, and communal kitchens; Medical Officer of Health.

Stirling.—Cleansing station for Stirling and Clackmannan A.R.P. Joint Authority; J. Clark Fyfe, architect, Stirling.

Stoke-on-Trent.—Re-building nurses' home at North Staffordshire Royal Infirmary; A. Burton, city engineer, Town Hall.

Stratford-on-Avon.—Fire station, for T.C.; P. C. Smart, borough engineer, Municipal Offices.

Sunderland.—Deep shelters; R.D.C. architect.

Surrey. — Extension of public shelter accommodation (£300,000), for C.C.; county architect, County Hall, Kingston-on-Thames.

Tadcaster.—Sewerage and sewage disposal works, Swillington, for R.D.C.; surveyor, Station Road, Tadcaster.

Taunton.—Public shelters (1,378 persons) for T.C.; borough surveyor, St. Paul's House, Taunton.

Warrington.—Works extensions, Hardy Street; Alliance Box Co., Ltd.

Extension to Orthopædic Department and re-construction of laundry (£12,000); secretary, Warrington Infirmary, Kendrick Street.

Warwickshire.—Alterations to P.A.C. institutions and hospitals; A. C. Bunch, county architect, Shirehall, Warwick.

Watford.—Feeding centres; borough engineer.

West Cumberland.—Houses for the North-Eastern Housing Association, Metrovick House, Northumberland Road, Newcastle-on-Tyne.

Wigan.—Dairy, etc., Bentley Lodge, Wrightington; J. Hutchinson.

Yarmouth. — Clinic, isolation hospital; borough engineer.

To Win the Peace

The Institution's Contribution

A NOTE which ran through the speeches at last week's luncheon of the East Midland Sub-Centre of the INSTITUTION OF ELECTRICAL ENGINEERS was the advisability of keeping an eye on the work to be done after the war. There was no doubt about our winning the war, said Mr. W. K. Brasher, secretary of the Institution, but would we win the peace? The short-term view and the long-term view had got to be taken together. He asked if the Institution could not have more constructive contributions from members in this way and suggested that the work entailed might easily be done by way of wartime relaxation.

In similar vein, Mr. J. R. Beard, president, I.E.E., said that thinking of how things can be made better after the war could be a useful means of escape from the war atmosphere or even of recreation in wartime. Capt. B. Croft Bayley, M.B.E., chairman of the Sub-Centre, in stressing the need for careful planning of the future, said it was the duty of electrical engineers to help in the decentralisation of industry.

Commenting on changing conditions as a feature of modern life, Mr. H. A. S. Wortley, M.A., principal, University College Nottingham, said he believed that electrical engineers would contribute to the change for the better which must come after the war and would be expressed in increased goodwill. The electrical applications of science which were helping to weld the world into one great family before the war were now helping to cure an international disease.

But the great contribution of the electrical industry to the present war effort was not neglected in the speeches, and Mr. Wortley was sure that in some way or other every one of the 20,000 or so members of the Institution was helping to win the war.

Referring to the success of the Central Register, the president pointed out that practically all the demand on the Register so far had been from the light-current field. Despite the lessened work on account of fewer meetings, the secretarial work of the I.E.E. had actually increased, largely because of the Register, but also because of other war activities such as the training schemes for the forces.